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REPORT ON WATER POLLUTION CONTROL - NORTH COASTAL BASINS, CALIFORNIA DRAINAGE BASIN

Public Health Service
San Francisco, California

July 1950

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REPORT
ON
WATER POLLUTION CONTROL

NORTH COASTAL BASINS

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Water Pollution Series No. 17

Report on

Water Pollution Control

NORTH COASTAL BASINS

California Drainage Basin

Prepared by:

California and Great Basin Drainage Basins Office
Division of Water Pollution Control
Public Health Service, Federal Security Agency

in cooperation with

State and Regional Water Pollution Control Authorities

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THE NORTH COASTAL SUB-BASIN OF CALIFORNIA

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INTRODUCTION

The Federal Water Pollution Control Act, Public Law 845, passed by the 80th Congress in June 1948, requires the Surgeon General of the Public Health Service to cooperate with other Federal agencies, with State and interstate water pollution control agencies and with municipalities and industries in the preparation or adoption of comprehensive programs for eliminating or reducing the pollution of interstate waters and tributaries thereof, and improving the sanitary condition of surface and underground waters.

In developing these programs, due regard must be given to improvements necessary to conserve the Nation's waters for public water supplies, propagation of fish and aquatic life, recreational purposes, agricultural, and other legitimate uses.

Recognizing the fact that full technical information was not available to permit the development of such comprehensive programs immediately for most of the Nation's waters, the Public Health Service envisioned the development of a series of reports to cover the interim period prior to the development of comprehensive water pollution control programs. The first of these reports were the Summary Reports which were prepared for the 15 major drainage basins of the country on the basis of information readily available as of July 1, 1950. The second group of reports of this series, of which this is one, are reports on several sub-basins of the country's major drainage basin areas. Since development of comprehensive water pollution control programs is to proceed as rapidly as conditions permit, only a limited number of these interim sub-basin reports are to be completed, and the majority of these will be for interstate sub-basin areas. These reports are based on data available as of July, 1950 and will provide a reference point for measuring progress; provide a guide to needed additional data; provide a basis for the logical development of comprehensive programs; provide a basis for approval of loans to States, interstate agencies and municipalities at such time as the Congress makes available funds for this purpose; and serve to inform the public on the water pollution control problem and needs for the sub-basin concerned.

The data on which this Sub-basin report is based have been compiled through and in cooperation with State water pollution control agencies, but should not be considered a detailed engineering investigation of the North Coastal Sub-basin. Through these cooperating agencies additional data have been obtained from other State officials, county and city officials and representatives of industry. Federal agencies also have been of great assistance.

The sub-basin reports present information about the ways the water resources of the area are used, the pollution entering those water resources and the resulting damages, the benefits which may result from pollution prevention and abatement, pollution prevention measures now in effect, and those which appear to be needed.

Since the sub-basin reports are based on data which are presently available, they do not discuss the present and future best uses of the waters of the sub-basin as such uses are related to pollution control. Such considerations will be included as a part of the comprehensive water pollution programs which will be developed later.

The deficiencies in data and the gaps in information indicated in these sub-basin reports are as significant as the presentation of available facts and statistics. They indicate the work that still needs to be accomplished by water pollution control authorities for the preparation of comprehensive programs.

Data and knowledge now available are sufficient, however, to permit the immediate solution of many of the pollution problems within the North Coastal Sub-basin without awaiting the results of additional surveys and studies.

A sincere effort has been made by all who contributed to this report to present a fair picture of the complex water pollution problems in the North Coastal Sub-basin and to present reasonable conclusions and recommendations. It is our hope that this report, as a step in the cooperative development of an ultimate comprehensive water pollution control program, will help in safeguarding the water resources of the North Coastal Sub-basin.

ACKNOWLEDGMENTS

This report was prepared by the California and Great Basin Drainage Basins Office of the Public Health Service in cooperation with the California State Department of Public Health, defined at the time the report was prepared, as the State Water Pollution Agency for purposes of Public Law 845. The California State Water Pollution Control Board and the North Coastal Regional Water Pollution Control Board reviewed the preliminary draft of the report and made valuable suggestions and recommendations for its improvement. Assistance, including consultation service, use of unpublished data and reports, graphical presentation and manuscript reviews, has also been given by the following agencies:

California Government Agencies
- Department of Agriculture
- Department of Natural Resources
  - Division of Fish and Game
  - Division of Forestry
- Department of Public Works
  - Division of Water Resources
- University of California

Federal Government Agencies
- Department of Agriculture
  - Forest Service
  - Soil Conservation Service
- Department of the Army
  - Corps of Engineers
- Department of Commerce
  - Bureau of the Census
- Department of the Interior
  - Bureau of Reclamation
  - Fish and Wildlife Service
  - Geological Survey
  - National Park Service
- Federal Power Commission

Private Agencies
- San Francisco Chamber of Commerce
- State Chamber of Commerce

Other organizations and individuals, including public officials and engineers in private practice, have contributed information used in the report.

SUMMARY

The North Coastal Basins include an area of over 8,680 sq. mi. extending approximately 280 miles along the northern California coast between the San Francisco Bay Area and the Klamath River Basin. The area includes numerous coastal streams, all in California, and is not a separate river basin or an interstate area as are the majority of the sub-basins in the United States to be covered by interim reports. The area covers such major river basins as the Russian, Eel, Mad and Van Duzen, and in order to avoid confusion, is referred to in this report as the North Coastal Sub-basin. The area includes all of Mendocino County, 83 percent of Sonoma County, 74 percent of Humboldt County, 22 percent of Lake County, 22 percent of Marin County, 20 percent of Trinity County, and 15 percent of Glenn County. The population of the Sub-basin was estimated to be 180,877 in 1950, a 47 percent increase since 1940, and is concentrated in the lower Russian River valley and the Humboldt Bay area.

The mean temperature in the Humboldt Bay area is approximately 51° F. and the difference between mean high and mean low temperatures is less than ten degrees. Annual rainfall varies from 30 inches in the south to 67 inches in the north and is adequate for most agricultural crops without irrigation.

The land area is utilized as follows: 7.8 percent cultivated or devoted to urban or industrial use, 23.6 percent grass or grazing woodland devoted to livestock grazing, 57.4 percent in timber, and 11.2 percent wasteland (the latter includes: chaparral, sagebrush, marsh, desert and barren land). The Russian River valley is one of the largest grape growing regions in the United States and also produces large quantities of other fruit and truck crops. Outside the Russian River valley lumbering is the principal industry in the Sub-basin. It is estimated that 73 percent of the redwood lumber produced in California comes from the Sub-basin. Stock raising, dairying, and fishing are also important. The famous redwood forests and the excellent trout and salmon fishing have been responsible for the development of many camps and recreational resorts in the area. Records of the California State Division of Fish and Game indicate that over 100,000 hunters and fishermen, alone, visited the Sub-basin in 1948.

Except for the effect of inadequately treated sewage and industrial wastes on limited stretches of several streams, the surface and ground waters in the area are satisfactory for all indicated uses including domestic and industrial water supplies, agriculture, sport fishing and recreation. Seven of the 19 communities with public sewer systems have provided secondary sewage treatment plants or have new plants under construction. Seven more of the communities have provided primary treatment or have new plants under construction. The remaining five communities with public sewer systems and two others with private or semi-public systems have not provided waste treatment facilities. Twelve more communities with populations of less than 500 and one with a population over 1,000 are not sewered

but are developing rapidly and will no doubt provide sewer systems in the near future. In some cases where secondary treatment is provided, broad irrigation or oxidation ponds are used. There are occasional complaints that sewage spilled from ponds or by-passed around irrigation fields has reached surface streams.

There have been isolated and seasonal occurrences of odor nuisance and pollution resulting from industrial waste discharge, but, in general, the problem of industrial waste disposal throughout the region has not been of large magnitude. Wineries, canneries, lumbering and wood processing are the major waste producing industries, but little specific information is available as to the measures adopted by these industries to avoid or prevent water pollution.

The location of the Sub-basin near the large San Francisco Bay population center assures a continuous market for fruit and truck crops and favors an increase in industrial development. Additional information on the industrial waste disposal methods now employed and appraisals of their adequacy are needed.

Preservation of the recreational value of the area and the insurance of acceptable water supplies for future population growth and industrial expansion require a vigilant program of water pollution control.

CONCLUSIONS

1. The total connected population of the 19 sewered communities in the Sub-basin is approximately 69,500. From the limited information available, it is estimated that the pollutional load of industries contributing to municipal sewers increases this total to about 97,000 population equivalent.

2. The pollutional load from sewers is reduced to approximately 55,100 population equivalent by treatment works. Of this total, 10,300 is discharged to the Russian River, 5,500 is discharged to the Eel River, 25,200 is discharged to Humboldt Bay, 4,800 is discharged to the Pacific Ocean, and 9,300 is discharged to land.

3. The following communities have provided sewage treatment facilities that were considered, by the California State Department of Public Health under the former permit system, to be satisfactory for present conditions: Scotia, Willits, Ukiah, and the Talmage State Hospital.

4. Fourteen communities in the Sub-basin have recognized the need for improved waste treatment facilities and now have projects in the planning, financing, or construction stages (Table A).

5. Seventeen communities of significance in the Sub-basin lack sewage treatment or sewage collection works, or both (Table B).

6. Four of the above 17 communities, having no treatment, and one other community, which now provides treatment, on the basis of currently available information may require sewage treatment works improvements, but have taken no steps to provide the necessary facilities (Table C).

7. The principal pollution hazards to water resources in the Sub-basin are: inadequate domestic sewage treatment plants or improperly operated domestic sewage treatment plants, the lack of suitable waste disposal facilities in recreational camps and unsewered communities, the increased activity in food processing and lumber industries, and the possible establishment of a pulpwood industry.

8. Lumbering, agriculture, and recreation are likely to continue as the principal factors in the economic development of the Sub-basin.

RECOMMENDATIONS

1. Communities and industries which have studied their waste treatment problems and have developed specific programs for solving them and those for which requirements have been prescribed by state pollution control authorities should proceed at once with construction of the necessary treatment facilities.

2. Vigilance should be maintained in preventing new sources and in eliminating existing proved sources of unreasonable impairment of underground water quality.

3. Because of the inadequacy of current information on industrial activities, field surveys should be made to appraise the effects of industrial waste loadings on surface and underground waters.

4. Construction of additional dams, hydroelectric power facilities and new water resources development projects should be preceded by a careful analysis of their effect on water pollution control.

5. Since the compilation of information which was available for the preparation of this report has indicated a definite need for factual data, steps should be taken to fill gaps in the following respects:

   (a) Production of industrial wastes, treatment in effect and foreseeable problems,
   (b) Determination of water quality throughout the Subbasin for evaluation of suitability of water resources for the uses in effect or proposed,
   (c) Hydrology of the river systems.

6. Comprehensive plans should be made and regulations enforced for protection of water quality in recreational areas.

7. Local, State and Federal agencies should cooperate fully in expanding public information programs on the subject of water pollution.

HISTORICAL BACKGROUND

The North Coastal Sub-basin is crossed by numerous small streams that flow from the coastal mountains to the sea. Under pristine conditions clear water and an abundance of fish and game characterized this Sub-basin and often determined names of streams such as Mattole River named after the Indian word meaning clear water. Bear Creek was so named because of the abundance of bears in its drainage basin, and Eel River when discovered by early settlers contained great numbers of eels (lamprey eels) that suggested its name. The Indian name of this river was Weott meaning plenty and having direct reference to the large number of salmon caught in its waters.

Names of places and rivers in this coastal area also reflect the presence of Spanish, Mexican and Russian settlers during early times. Probably the earliest record of discovery in the Sub-basin was made in 1579 by Sir Francis Drake who observed the point of land now known as Cape Mendocino, the westerly limit of Continental United States. His explorations were followed by those of Spanish navigators notably Vizcaino who, in 1603, discovered Cape Trinidad in Humboldt County.

Spanish colonization of California did not begin until 1769 when Mission San Diego de Alcala, the first mission in California, was established. Gradually, other Spanish missions were located northward until in 1823, one year after the beginning of Mexican rule, the last one was built in Sonoma County, ten miles north of San Pablo Bay. In this county Mexican influence was confronted with the arrival of Russians from Alaska. In 1811, attracted by a favorable climate and by rich forest and agricultural lands, these northern settlers took possession at Bodega and settled in the Russian River area. A few years later hostile Indians and Spaniards forced the colony, that numbered "250 souls", to seek a suitably protected location a dozen miles up the coast from the mouth of the Russian River. The settlers called their new establishment Rossiya (Little Russia) and, with the Spanish prefix fuerte, there developed the present name Fort Ross.

Originally, the District of Sonoma comprised all the territory west of the Sacramento River and north to the Oregon line, including among others, the present-day counties of Sonoma, Mendocino, Humboldt, and Trinity. The District received its name from the Indian word "Sonoma" meaning "Valley of the Moon", believed to have applied to a valley where in winter the moon appears and disappears seven times as it curves upward behind the surrounding mountain peaks.

The period of Mexican rule was marked by the arrival of numerous traders and pioneer American settlers led by such trail blazers as Jedediah Smith and Joseph Walker. The Russian influence became relatively small and ended in 1843 when the settlers returned to Alaska. Five years later the era of Mexican control in California likewise terminated with the signing of the treaty of Guadalupe Hidalgo, and California was admitted to the Union as the 31st State on September 9, 1850.

Great influxes of prospectors followed the discovery of gold on the American River in 1848. Thereafter, a rapid utilization of the immense redwood timber resources and productive agricultural lands in the northern counties resulted in an era of great economic development that has continued to this day. (Plate 1, Appendix)

PHYSICAL DESCRIPTION

Geography - The Sub-basin lies entirely within the State of California and extends from the mouth of the Klamath River on the north to the mouth of Lagunitas Creek, Tomales Bay on the south. The eastern ridge of the Coast Range forms its eastern boundary and the Pacific Ocean its western boundary. It contains over 8,680 sq. mi. and is approximately 280 miles long. No point in the area is over 50 miles from the Pacific Ocean. The portions of the counties that are within the area are as follows: Mendocino 100 percent, Sonoma 83 percent, Humboldt 74 percent, Lake 22 percent, Marin 22 percent, Trinity 20 percent, and Glenn 15 percent. (Table 1, Appendix)

Topography - The region is drained by the Eel, Van Duzen, Russian, and Mad Rivers plus numerous smaller streams which collect the run-off from the extreme western slopes of the Coast Range. Among the latter streams are the Mattole, Noyo, Navarro, and Gualala Rivers. The Eel River drains an area of 3,675 sq. mi. It is approximately 160 miles in length and its slope varies from 0.2 ft. per mile in the delta to 50 ft. per mile in the headwaters of the tributaries. A portion of the Eel River flow is diverted to the Russian River at the Van Arsdale Dam. The Van Duzen River joins the Eel at a distance of 12 river miles above the mouth. It is approximately 70 miles in length and drains 432 sq. mi. of the area reported for the Eel River Basin. It has its origin at about 3,500 ft. above sea level and joins the Eel at an elevation of about 35 ft. The Mad River, which drains an area of approximately 1,000 sq. mi., rises in Trinity County among peaks ranging from 5,000 to 7,000 ft. in elevation. The river headwaters are at 2,900 ft. elevation, and the main stream is slightly over 100 miles in length. The Russian River is about 100 miles long and drains an area of 1,485 sq. mi. This area is about 80 miles long and varies from ten to 30 miles in width. It is located between adjacent ridges of the Coast Range. (Table 2, Appendix)

In general, elevation increases from west to east in the Sub-basin. The eastern ridge line, which forms the divide between the coastal region and the Central Valley region, ranges from an elevation of 7,000 ft. in the north to 3,000 ft. in the south. The western ridge of the Coast Range varies from 3,000 ft. in the north to a few hundred ft. in the south. With the exception of the Russian River, the valleys of the Sub-basin slope to the northwest in the opposite direction from the ridge slopes. The most prominent mountains are in the eastern portion of the area, and high mountains lose their individuality in that portion of the Sub-basin above 40° N. lat. Better known mountains of the area are Mt. St. Helena, east of Healdsburg, Mt. Sanhedrin, and Hull Mountain in the vicinity of Lake Pillsbury. The most highly developed portions of the area lie at elevations of approximately 1,000 ft.

The largest body of fresh water in the Sub-basin is man-made Lake Pillsbury which serves as a reservoir for the Potter Valley Powerhouse. The controlled release from Lake Pillsbury is diverted from the channel of the Eel River at the Van Arsdale dam and reservoir, twelve miles below the lake. Flow from the powerhouse tailrace

provides for irrigation of the fertile upper valley of the East Fork of the Russian River and supplies the major portion of the dry weather flow of the Russian River.

The Department of the Army, Corps of Engineers, has recommended* that two additional reservoirs be constructed in the Russian River valley. One reservoir with an ultimate capacity of 199,000 acre-feet would be constructed at Coyote Valley on the Russian River near Ukiah, and the second with a capacity of 216,000 acre-feet would be constructed on Dry Creek, a tributary of the Russian River, near Healdsburg.

With the exception of about 500 sq. mi., which are being farmed, the Sub-basin is covered by natural forests and extensive growth of manzanita and chaparral. The principal trees are California redwood, Douglas fir, and live oak.

Geology - The extreme northern portion of the area is underlain by metamorphic rocks and the rest by argillaceous sandstones, shales, and conglomerates. The general structure of the area is characterized by a succession of large folds which run northwest and southeast. These folds are higher and sharper in the northeast and generally decrease in height and sharpness to the southwest. The area is not geologically mature, and slides and stream changes are frequent. Among notable features of the area is the San Andreas fault which runs northwest near Jenner.

Climate - The climate of the area is tempered by the Pacific Ocean and affected by altitude. In general, the coastal portion of the Sub-basin is cool and moist, with a difference between mean high and mean low temperatures of less than 10° F. The mean yearly temperature at Eureka on Humboldt Bay is approximately 51° F. The valley regions of the Eel, Russian, and Mad Rivers present conditions which are intermediate between the coast and the Central Valley. Temperatures vary inversely with altitude and latitude with a mean high of 74° F. at Healdsburg and a mean low of 37° F. at Ruth. The yearly mean temperature of the valleys is approximately 54° F.

Growing seasons range from 173 days at Branscomb on the headwaters of the Eel River to 334 days at Scotia on the lower Eel. The most important agricultural lands in the area have between 200 and 240 days in each growing season. The Sub-basin is typical of California with sharply defined wet and dry seasons. Generally there is no precipitation in the area during June, July, and August, and only minute amounts in May and September. Annual rainfall increases, in general, with altitude and latitude. It ranges from 30 in. at Santa Rosa to 67 in. at Blocksburg near the headwaters of the Van Duzen River. The most heavily farmed areas receive between 35 in. and 40 in., mostly during the winter months. Snowfall represents only a very small portion of total precipitation. Since the snow cover is of short duration in this area, its effect is little different than that of rain.

Hydrology - Stream flows in the Sub-basin vary greatly between the wet and dry seasons. The steep impervious slopes, which prevail over the greater part of the area, provide little underground storage, and dry weather flows become very low. Many of the smaller streams

*Survey Report for Flood Control and Allied Purposes in Russian River California. Report 23, Department of the Army, Corps of Engineers, September 9, 1948.

frequently go dry during the summer months. Among these are Orr Creek near Ukiah, Dry Creek near Healdsburg, and Santa Rosa Creek near Santa Rosa where, at times, sewage treatment plant effluents are discharged to dry stream beds. The major streams maintain some flow throughout the year, but the fluctuation is great. Stream flows, inadequate for waste dilution purposes, will necessitate wastes receiving a rather high degree of treatment before discharge to the outlet streams.

One important man-made effect on stream flow is the diversion of Eel River water at the Van Arsdale Reservoir to the East Fork of the Russian River through the Potter Valley Powerhouse. This diversion provides the major portion of the dry weather flow of the Russian River. Proposed flood control reservoirs and power developments may, of course, alter the regimen of streams in the Sub-basin if and when constructed.

The hydrological records for the streams of the Sub-basin were studied and certain summary data for key points are given in Table 3, Appendix. Maximum and minimum flows for the period of record show the extreme values and therefore the degree of fluctuation in flow. Columns six and seven of this table, which present data on lowest mean monthly flows and lowest mean flow for seven consecutive days, are particularly valuable for purposes of evaluating water pollution problems. Information on flood or peak flows may also be of importance, if such flows are to be utilized for disposal of stored or ponded wastes.

Data on stream flows, particularly the low flows that may be expected and their frequencies and times of duration, are essential in determining the degree of treatment required for wastes that are discharged to a stream. It is of significance to note that the California Division of Water Resources is enlarging the scope of its activities in this Sub-basin to permit more complete compilation of stream flows.

ECONOMIC DEVELOPMENT

The population of the Sub-basin was 74,543 in 1900 and 122,680 in 1940 as compared to a population of 1,485,053 in 1900 and 6,907,387 in 1940 for the State of California. During the 40 year-period from 1900 to 1940 the percent of increase in population in the Sub-basin was 65 as compared to 365 for the State. (Tables 4 and 5, Appendix)

The population of the Sub-basin was estimated to be 180,877 in 1950, an increase of 47 percent from 1940 to 1950. The estimated population of the State of California was 10,472,348 in 1950, an increase of 52 percent for the ten-year period. (Table 5, Appendix)

Most of the population of the Sub-basin is concentrated in the lower valleys of the main watersheds, especially in the Russian River and the Humboldt Bay areas. Eureka, on Humboldt Bay, and Santa Rosa, in Sonoma County, with 1950 populations of 22,926 and 17,905, respectively, are the largest cities in the area. Fort Bragg, Ukiah, Arcata, Healdsburg, Sebastopol, and Willits are other cities with 1950 populations of from 2,000 to 6,000.

The rate of population increase for the North Coastal Sub-basin from 1900 to 1940 was much less than for the State, due largely to lack of industrial development in the Sub-basin. However, during recent years, industrial development has increased in the area and the rate of population increase since 1940 has been more nearly comparable to that of the State.

The production of fruits, vegetables, and field crops, and the raising of cattle, sheep, hogs, and poultry comprise the principal agricultural activities of the Sub-basin. Major industries include approximately 70 wineries, 24 fruit and vegetable processing plants, 24 milk handling and processing plants, six fish processing plants, and numerous lumber mills. (Plate 2, Appendix)

The Russian River is one of the largest grape growing areas in the United States and most of the grapes are processed into wine or other grape products in the area. The raising and processing of orchard and truck crops are also important activities in the Russian River drainage area. In this watershed, a mild climate and scenic surroundings have resulted in recreational development by private capital of much of the river shore in the vicinity of Fitch Mountain and below Mirabelle Park to the ocean. In 1946, the value of the existing facilities for accomodation of visitors on the lower reaches of this river was estimated to be $12,646,000. This attractive area may be reached by car within two hours normal driving time from San Francisco making it possible to use the area for holidays and weekends as well as extended vacations. (Tables 6 and 13, Appendix)

Lumbering is the principal industry in Humboldt and Mendocino Counties. In 1946, the combined production of redwood lumber in these two counties was 178,212,000 board feet as compared to 243,310,000 board feet for all of California, or 73 percent of the total production for the State. Production of pine and fir lumber is also important.

While fishing fleets operate along the entire coast of the Sub-basin, fish processing plants are centered mainly around Humboldt Bay.

There is little seasonal industry in the area and not much seasonal demand for labor except during the fruit harvest in Sonoma County. This region is so near the large population centers of the San Francisco Bay area that transient labor can easily be obtained as required. Persons engaged in live-stock and poultry raising, dairying, fishing, and similar enterprises are largely self-employed and require little outside labor. The lumber industry, particularly in the redwood areas, has been set up on a permanent basis with steady employment for the comparatively small labor force required. (Table 6, Appendix)

Although farming is the leading occupation of most of the people living in the area, only 432,000 acres or about eight percent of the total area of 5,563,000 acres in the North Coastal Sub-basin are cultivated or devoted to urban or industrial use. An additional 1,310,000 acres or about 24 percent of the area are in grass or wooded grassland devoted to livestock grazing. A total of 3,199,000 acres or about 57 percent of the total are in timberland some of which may be used for grazing, and 622,000 acres or about 11 percent of the total are wasteland including chaparral, sagebrush, marsh, desert, and barren land. (Table 7, Appendix)

There is little irrigated land in the area except in the Russian River region. A total of 16,900 acres of land was irrigated in 1944 in Sonoma and Mendocino counties, almost all in the Russian River area. The Bureau of Reclamation estimates that there is a total of about 80,400 acres of irrigable land in the Russian River area; but of this total only 25,450 acres are of class "1" soil of the highest type, 39,500 acres are of class "2" soil which is limited in the choice of crops that can be grown, and 15,450 acres are so rough or the soil so poor that they offer little possibility except for irrigated pasture.

There is little irrigated land in the Eel or the Mad River areas as the high annual rainfall permits production of crops on the small acreage of available land with dry farming methods.

California has a great variety of minerals of possible commercial importance (in all 53). In this regard the North Coastal Sub-basin is no exception as sand, gravel, stone, gold, quicksilver, mineral water, limestone, platinum, manganese, clay, graphite and lignite are found in the area. However, the value of these products produced in 1947 was only about one million dollars or slightly over one-tenth of one percent of the total mineral production value for the State.

Over 50 percent of the income from mineral resources is derived from sand, gravel, and stone taken mainly in Humboldt, Mendocino and Sonoma Counties, and mined from bars on the Russian River east of Ukiah and along the Eel and Mad Rivers. The only important source of quicksilver in the area is near Guerneville in Sonoma County, four miles north of Russian River. Although there are small quantities of several other minerals mined in this Sub-basin, the amount is relatively small.

In the North Coastal Sub-basin the five principal timber producing trees are redwood, Douglas fir, white fir, ponderosa pine and sugar pine. The total 1946 production of these five species was approximately 440 million board feet, about 95 percent of which came from Humboldt and Mendocino Counties. (Table 8, Appendix)

The Sub-basin includes a total of nearly two and one-half million acres of timber cropland representing areas where at least 20 percent of the ground is covered with timber growth. Of this acreage, about 23 percent is privately owned. (Table 9, Appendix)

Lumber production in this region during the war years underwent a marked increase as is indicated by the trend in Mendocino County from about 124 million board feet during 1940 to around 185 million in 1945.

No commercial deposits of petroleum have been located in the North Coastal Sub-basin. One oil well was drilled in Sonoma County with a production rated at 25 barrels per day in 1947, but the well is located four miles east of Petaluma just outside the Russian River basin between Santa Rosa and San Pablo Bay.

Natural gas is produced on a commercial basis from wells 2-1/2 miles east of Fernbridge in Humboldt County and three miles east of Willits in Mendocino County. There are indications of oil in bituminous shales and sandstones at various points in the area, but no producing wells have been developed.

In order of importance deer and quail are the dominant game animals of the North Coastal Sub-basin. Deer are fairly uniformly distributed throughout the region and their numbers are definitely above average for the State. It has been estimated that in 1948, out of a total of over 60,000 hunters in the area around 45,000 or more were deer hunters, their kill numbering about 12,000 deer.

The quail population of the area is at least average for the State, their numbers being greatest in Sonoma and parts of Mendocino County. It has been estimated that in 1948 there were over 13,000 quail hunters in the area, their take amounting to over 130,000 birds.

Relative to the entire State the number of pigeons in the Sub-basin is above average and in the northern part of the watershed the number of bears also exceeds the State average. All other game animals are below the average for the State.

Game, as a natural resource, is believed to be of considerable economic value to this area. Primitive conditions for the growth of the game populations are quite extensive and are suitable for an expansion of current numbers under modern game management practices. Under present conditions much of the game hunting is done by local residents, but the future possibilities for attracting more hunters from metropolitan areas appear to be good. (Plate 1, Appendix)

Principal economic assets of the North Coastal Sub-basin are agriculture, forests, and recreation. Statistical estimates of the California Department of Agriculture show an increase in cash farm income (gross returns to the farmers) for the Sub-basin of approximately 25 percent during the period 1943-1948. In view of the price increases during that time, it appears that the total amount of agricultural production was reasonably stable. In the North Coast Agricultural District*, the commercial production of milk fat increased from 8,153,000 pounds in 1939 to 9,633,000 in 1948. In general, under the influence of wartime conditions, prices of agricultural commodities soared and levels of production were reasonably well maintained.

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*This district includes Del Norte, Humboldt and Mendocino Counties.

With the increase in use of mechanized equipment since 1935, "selective cutting" in the redwood forests has increased over 50 percent. Greater numbers of seed trees are left behind, more protection against soil erosion is given the watershed, and rivers and streams are more protected against the threat of silt. Also, there is a trend toward more extensive use of large, privately owned, acreages of young growth, and the prospects are good for establishing a pulp industry in the Sub-basin. Conceivably, this presents a potential threat to the purity of the rivers and streams in the area.

Postwar population increases have been followed by a greater use of the Sub-basin's recreational facilities. A continuation of this trend will be influenced by the quality and quantity of water and the permanence of flow in the rivers and streams of the area. Referring to the Eel River section of this Sub-basin, a National Park Service report* concludes that the impact of California's population growth will result in an increase of the tourist patronage even if low stream flows continue without augmentation. It is highly important that the construction of all dams and power facilities be preceded by a careful analysis of their effect on existing water conditions. Such studies may decide future trends in the use and economic development of the Sub-basin.

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*Eel River Basin, California. Code No. XLIII/105. Preliminary Project Report on Recreational Facilities and Potentialities for San Francisco District Engineer, Department of the Army, Corps of Engineers, 1948.

USES OF WATER RESOURCES*

Surface waters only, such as rivers or spring-fed creeks, are used by six cities and towns in the area as sources of public water supply. These communities have a combined population of 31,842. Six additional communities with a combined population of 29,956 depend upon a combination of surface supplies and ground water supplies from wells and springs while seven communities with a combined population of 10,352 use only ground water as a source of water supply. (Table 10 and Plate 4, Appendix)

There are many semi-public water supplies in the Sub-basin, with less than 200 service connections, serving small communities, parks, and camps which have not been required to obtain permits from the State Department of Public Health and for which little information is available. Many of these supplies are taken from surface streams without treatment.

Only two of the communities, Santa Rosa and Sebastopol, have deep wells as most of the cities and towns are located in valleys where it has been possible to obtain water from shallow wells. Most of the rural population is concentrated in the lower valleys of the main streams and uses water directly from the streams or from shallow wells where the ground water is replenished directly from flowing streams.

Scotia taking water from Eel River, and Eureka taking water from the Mad River are the only communities at present depending entirely on the larger rivers as a source of public water supply. Garberville also has a pumping station on the South Fork of the Eel River, but uses this source only in the summer to augment its supply.

There are approximately 70 wineries including four fruit distilleries as well as many fruit and vegetable canning and preserving plants in the Russian River valley. These industries require considerable quantities of processing and cooling water, but little information is available as to the sources of supply used. To fill this gap, field contacts with the respective industrial concerns are necessary. It is believed that in most cases ground water supplies are used rather than surface supplies. Most of the ground water supplies come from shallow dug wells or infiltration galleries taking water from river sand and gravel deposits.

Not much water is used in the lumber mills except for boiler and cooling water. No pulp wood industry has been developed in this area, but construction of the new Masonite plant at Ukiah may indicate a trend in that direction.

There are a few other industries such as fish canneries and reduction plants, animal products processing plants, breweries and tanneries that require industrial water supplies for processing or cooling purposes.

The rivers and creeks in this area are generally used for livestock watering except in those Federal or State forests or parks where livestock grazing is not permitted.

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*Plate 3 indicates water uses by stream stretches in which they occur.

Irrigation is rather widely practiced in the Russian River valley as indicated by the following table showing the location of areas irrigated in 1944:

Location of Irrigated Lands	Net Area Irrigated in 1944
Potter Valley	3,710 Acres
Hopland Valley	941 "
Ukiah Valley	3,621 "
Alexander Valley	1,928 "
Dry Creek Valley	684 "
Santa Rosa Plains	4,986 "
Russian River below Healdsburg (Eastside)	835 "
Total	16,905 Acres

The Potter Valley area is the only one for which a gravity irrigation system has been developed and for which actual quantities of irrigation water used are known. This system takes water directly from the tailrace of the Potter Valley powerhouse, whose source is water diverted from the Eel River. In 1944, a total of 9,734 acre-feet of water was supplied to the irrigation district. The other areas depend upon individual pumping stations, using streams or wells as the source of water.

Construction of the Coyote Valley reservoir as proposed by the Corps of Engineers would permit an increase of 12,355 acres of irrigated land over the total irrigated in 1944. A total of 9,991 acres of this land would be Class "1"; 2,132 acres would be Class "2"; and 232 acres would be Class "3-A". An additional 22,728 acres of land could be irrigated upon completion of the ultimate stage plan of improvement, 4,300 acres being Class "1"; 15,032 acres Class "2"; and 3,396 acres Class "3-A". Class "1" land is described as the highest type of arable land, suitable in all respects for the production of a wide variety of crops. Class "2" land is intermediate in character and limited by soil, topography or drainage, to the choice of crops that can be grown. Class "3-A" soil is definitely inferior and limited to a very narrow range in agricultural possibilities.

The North Coastal Sub-basin includes about 280 miles of coast line, along which commercial fishing is carried on. These fisheries include fin fish, crabs, and shellfish (Mollusca). The predominant fin fish are sole, salmon, rockfish, Pacific herring, and shark in order of poundage, representing catches of over 21 million pounds out of a total of about 24 million pounds for the area*. Practically all the landings are in the Eureka area of Humboldt County. Salmon is about the only commercially important anadromous fish, the 1947 landings amounting to nearly six million pounds. (Table 11, Appendix)

*Figures used here represent values of the California Division of Fish and Game for the 1947 commercial fish landings in the Eureka area exclusive of boat landings from waters north of the State boundary (Table 11, Appendix)

The market crab, Cancer magister, sometimes called the white crab or Dungeness crab, comprises a five million pound annual fishery in the Sub-basin. The principal crabbing areas are north of the mouth of the Eel River. Until 1938, only about six percent of the state crab landings were made at Eureka. Thereafter, due to legalizing the shipment of crabs caught anywhere in the Eureka area, the percentage landings there increased from 6 to 36 percent for the period 1938-1947.

The coast line of the area is lacking in bays and estuaries, and ocean beaches are likewise scarce. Consequently, oyster grounds and clam beaches are few in number and small in area. Seed oysters from the East, Crassostrea virginica, and from Japan, Ostrea gigas are cultured in Tomales Bay. During the nineteen-thirties efforts were made to grow the native oyster Ostrea lurida in Humboldt Bay but production was interrupted by the war. These bays have an oyster growing capacity of over two million pounds per year and their maximum use is predicated largely upon pollution prevention and control.

While there is no commercial clam fishery now, considerable quantities of clams are taken by sportsmen from the bays and beaches along the coast. Other molluscan forms that enter into the commercial salt water fishery are of minor importance. They include octopi, the principal commercial species being Paroctopus apollyon, and the common squid Loligo opalescens, all of which are produced in relatively small quantities within this area.

It is interesting to note that the whaling station at Fields Landing, until burned in 1949, was the only whaling station in operation in continental United States. Sixty-six whales were processed here in the 1947-48 season. Oil, meat, poultry food and fertilizer were made. The conversion plants developed an extremely offensive odor. Wastes were discharged to Humboldt Bay. In 1940 and again in 1943 the California Division of Fish and Game investigated complaints made against the plant.

The North Coastal Sub-basin is a mountainous and well wooded area with clear, cold, mountain streams that favor a stable fish population. Years ago, the numerous tributaries teemed with salmon and trout, and today these anadromous forms still comprise the main attraction for the sportsman. Several species of trout and salmon occur in the area, but steelhead trout, Salmo gairdnerii, king salmon, Oncorhynchus tshawytscha and silver salmon, O. kisutch comprise the bulk of the catches.

The sport-fisherman's use of the area begins in the spring and early summer with fly, spinner, and bait fishing for young steelhead trout and, to a lesser extent, for young silver salmon. In most years a few adult steelheads, especially small individuals or "half pounders," and an occasional king salmon are found during August in the downstream reaches of certain of the larger ocean tributaries. However, the most intense angling occurs during the period from October to February.

An idea of the use of this Sub-basin by sport-fishermen is indicated by the 1948 catch of nearly 1,500,000 trout by approximately 44,000 fishermen and around 67,000 salmon by almost 14,000 anglers. Other fish caught in relatively small numbers include sunfish, catfish and black bass. Interestingly, it has been pointed out by Leo Shapovalov, Supervising Fisheries Biologist of the Bureau of Fish

Conservation of the California Division of Fish and Game, when writing about the Eel River watershed of this Sub-basin, that the number of native species is remarkably small, there being only one strictly fluvial species present, namely the sucker. (Table 12, Appendix)

Surf fishing provides sport for an increasingly large number of fishermen. Shore catches include: species of rock fish, kelp bass and sand bass. Among the shellfish, abalones are taken by sportsmen as well as by commercial fishermen.

The principal waterfowl hunting area in this Sub-basin is Humboldt Bay. According to the record of the Bureau of Game Conservation of the California Division of Fish and Game, there were around 7,500 waterfowl hunters in the Region during 1948, the kill totaling over 170,000 birds.

The areas in the Russian, Eel, and Coastal river basins discussed in this report comprise part of the "Redwood Empire," one of the principal recreation and vacation lands of Northern California. In the lower portion of the Russian River, in the vicinity of Guerneville, Monte Rio, and Rio Nido, there are scores of vacation resorts. Many of the resorts have private beaches on the river and public beaches are generally accessible in this area. At Healdsburg the Russian River is dammed each summer just below the city to form an outdoor bathing pool in the river channel. In addition, the river is utilized at pools and holes practically along its entire course by local residents for recreational bathing. Canoeing and boating in the summer time in the resort area, and steelhead trout fishing in the winter months from above Cloverdale to the river's mouth at Jenner are other recreational uses made of the stream.

On the South Fork of the Eel River from the vicinity of Garberville to its junction with the main stem of the Eel at Dyerville and then downstream to the mouth of the Eel, there are extensive resort and cabin developments for recreation as at Benbow, Garberville, Richardson Grove State Park, Miranda, Weott, etc. At practically all resort and cabin sites there are accessible pools in the river utilized by vacationists for recreational bathing. Many trout fishermen are attracted to Mad, Van Duzen, Mattole, Noyo, Navarro and Gualala Rivers as well as to the Eel River. The Eel River drainage area has over 21,000 acres in state parks which, according to the National Park Service, accounted for approximately 700,000 visitors in 1946.

The streams and the recreational activities they offer have played a large part in the development of the Sub-basin. As previously mentioned, the value of facilities for accomodation of visitors in the lower Russian River alone was estimated at over $12,000,000. in 1946. (Table 13 and Plate 1, Appendix)

None of the streams in the North Coastal area is considered to be navigable except by canoe or small boat incidental to hunting, fishing, and recreation. Humboldt Bay has been improved by the Federal Government for ocean-going vessels up to 28 ft. draft, and an extensive foreign and coastwise lumber trade is carried on through this port.

Only two public hydro-electric power developments have been constructed in the Sub-basin. The larger one, now owned by the Pacific Gas and Electric Company, includes a reservoir on the Eel River (Lake Pillsbury) with a storage capacity of 94,000 acre-feet, a diversion dam

(Van Arsdale) 12 miles below the reservoir, a tunnel through the divide, and a power plant with an 8,800 kilowatt installed capacity at Potter Valley on the Russian River. The smaller plant owned by the Northern Light and Power Corporation is located at Benbow on the South Fork of the Eel River with installed capacity of only 700 kilowatts.

Application has recently been made for a preliminary permit for Federal Power Commission Project No. 2049 according to information provided by the California Division of Fish and Game. This project is to be constructed on the middle fork of the Eel River, Hull's Creek and Short Creek in Mendocino and Trinity Counties and will probably be the first of several power developments planned for this region.

The power possiblities of the Russian River have been studied by the War Department in connection with the study of the multiple-purpose reservoirs at Coyote Valley and Dry Creek. It was concluded that power development at the Coyote Valley reservoir might be justified if the maximum capacity of 199,000 acre-feet is provided during the first stage of construction before demand for the surplus water has developed for agricultural purposes or export. There would be no possibility of economical power development at the Dry Creek reservoir and none at the Coyote Valley reservoir unless the dam is completed in one stage.

If the Corps of Engineers' plan for flood control and development of the water resources of the Russian River is adopted, a reservoir with 199,000 acre-feet capacity will be constructed at Coyote Valley on the Russian River near Ukiah. The storage capacity will be alloted as follows: 48,000 acre-feet for flood control to take care of the estimated 50-year flood, 4,000 acre-feet to compensate for siltation of the storage reservoir over a 50-year period, 48,000 acre-feet for conservation purposes to maintain a minimum flow of 200 cubic feet per second in the Russian River at Guerneville, and 99,000 acre-feet for domestic or agricultural use in the Russian River Valley or for export to areas outside the valley. A reservoir with 216,000 acre-feet capacity would also be constructed on Dry Creek, a tributary of the Russian River near Healdsburg, with 60,000 acre-feet of storage available for water for export from the Russian River Valley in addition to the storage capacity required for flood control, siltation, and domestic and agricultural use.

POLLUTION CONTRIBUTED TO WATER RESOURCES

Domestic and industrial wastes from 19 public sewer systems with a total connected population of 69,500 are discharged to the waters of the Sub-basin. These wastes, with an estimated population equivalent of 55,100, after treatment, are discharged as follows: 10,300 to the Russian River; 5,500 to the Eel River; 25,200 to Humboldt Bay; 4,800 to the Pacific Ocean, and 9,300 to land. Wastes from one additional community with a population of 1,200 are discharged to the Pacific Ocean and those from one community with a population of 500 are discharged to the Russian River. These two communities are partially served by private sewers, and the connected population is unknown. (Plate 5 and Table 14, Appendix)

Some wastes from private disposal systems may also reach the Pacific Ocean from Rockport, the Eel River from Fernbridge and Weott, and the Russian River from Cotati, Forestville, Geyserville, Guernewood Park, Asti, Guerneville, Montesano, Monte Rio, Pinehurst, Rio Nido, and Villa Grande. Only one of these communities has a resident population of over 500, but those on the Russian River present a serious problem as they are mostly resort areas with populations swelling to many thousands during the summer vacation season.

The California State Department of Public Health reports that "a survey in the recreational area along the Russian River, conducted in 1945 by the Sonoma County Health Department showed that the area, except for some of the incorporated places, depends upon individual sewage disposal systems. Of 550 places of human habitation inspected, 24 percent showed plain evidence of human waste water, raw sewage, or septic tank effluent reaching the river. The survey also indicated the rarity of cesspools. The locker buildings on the bathing beaches usually have privies but there is no record of any difficulties.

"Sonoma County tried to develop a sewage disposal plan for relieving the difficulties in the recreational area. Two districts were formed and permits were issued by the State Department of Public Health but the financing fell through when a $3,000,000 bond election failed in 1948."

The Humboldt Bay area and the Russian River receive the heaviest pollutional loads in the Sub-basin. Humboldt Bay receives wastes from the rapidly increasing populations of Arcata, Eureka, Samoa and Fields Landing. The movement of part of the fishing industry from San Francisco Bay to Humboldt Bay and the rapid development of wood products industries in the area have resulted in rapid growth of these cities. New industries at Santa Rosa and Ukiah and greater use of the recreational facilities along the Russian River have also resulted in rapidly increasing the population of the Russian River area.

The pollution contributed to streams used for disposal of domestic sewage is increased in many instances by industrial wastes discharged to municipal sewer systems or discharged to the streams through private sewers.

The Santa Rosa municipal sewer system receives industrial wastes from a brewery with an estimated population equivalent of 12,000; a tannery with an estimated population equivalent of 2,400 to 5,000; and a food processing plant with an estimated population equivalent of 1,000 to 3,000.

The population equivalents for these industrial wastes were reported in the files of the State Department of Public Health and reflect evaluations of these pollution loadings made by State sanitary engineers in the course of their activities in the area.

Directories of Manufacturers Associations list 16 apple packing and processing plants at Sebastopol. Some of these plants are located outside the city and may discharge wastes through private sewers to tributaries on Mark West Creek. No information is available as to the treatment or population equivalent of these wastes. Six apple packing plants are reported to use an acid wash and dispose of the waste washwater underground.

The Healdsburg municipal sewer system receives industrial wastes from four fruit and vegetable packing plants, which do not ordinarily operate simultaneously, with an estimated total population equivalent of 5,000, and several wineries with an unknown population equivalent. Other industrial wastes in this area may be discharged through private sewers.

A winery at Ukiah formerly discharged wastes to a gravel bar of Orr Creek, near the shallow well used for the public water supply. The Masonite Company is constructing a new wood products plant at Ukiah which may have a waste disposal problem.

At Ferndale and Loleta, creameries discharge wastes to the municipal sewers. A large creamery at Fernbridge discharges wastes directly to the Eel River.

The Eureka municipal sewer system receives wastes with an unknown population equivalent from woolen mills, dairies, and fish and other food processing plants.

Probably the largest potential sources of industrial pollution in the Sub-basin are the wineries and numerous fruit and vegetable processing plants in the Russian River Valley (Plate 2, Appendix). Little information is available as to the pollution contributed to the surface and ground waters of the area from these sources.

In Humboldt and Mendocino counties, the lumbering industry is the greatest potential source of industrial pollution. The United States Forest Service lists for 1946, 100 active lumber mills in Humboldt County, 93 in Mendocino County, 28 in Sonoma County, 29 in Trinity County, and nine in Lake County. There are now approximately 320 lumber mills in the Sub-basin according to an estimate by the California Division of Forestry. (Tables 7 and 8, Appendix)

The State Forester maintains no list of sawmills, and he points out that so many mills are being reactivated and new ones built, due to the boom in the lumber business, that any given list would soon be incorrect. Though not necessarily complete nor up-to-date, in all respects, the best source of information for existing sawmills appears to be directories such as those of the West Coast Lumberman's Association or the Forest Products Industry Directory of Western North America.

In the larger mills the sawdust is used for fuel or processed into commercial fuel, whereas in the smaller mills sawdust and other wastes are burned in waste burners or may be discharged to the nearest stream. In addition, logging of the timber and the construction of temporary roads in these lumbering operations increases soil erosion and silting of streams.

Garbage is disposed of at Fort Bragg and at many other places along the coast by dumping over rocky bluffs to the ocean shoreline. The amount of organic pollution is not great but the dumps do create a local nuisance condition and make the area generally less attractive to tourists.

Due to lack of flood control installations, peak run-offs cause considerable damage to crop land agriculture in the Sub-basin, but no damage figures are readily available. Soil erosion has not been considered a serious problem in the Redwood region except in localized watersheds of grass and woodland cover type where overgrazing or burning has reduced the cover to a point at which the soil is no longer protected.*

Stream bank erosion has been serious for many years over a long mileage of streams, particularly the Eel River. Here it has been the source of much of the siltation in the lower reaches of the stream.

Old erosion scars are visible throughout the area in the steeper grassland types indicating slides or slippage resulting from soil saturation above hardpan. Extensive sheet erosion is not obvious. There are indications of extreme silt and gravel loads in the main rivers draining woodland cover types, and it is gathered from local heresay that the depth of gravel and debris in stream channels has increased markedly in the last 28 years. It has been observed by the U. S. Forest Service personnel that a fair percentage of Douglas fir, hardwood and chaparral types occurs on thin soils at a delicate angle of repose and where land slippage is common. Under these conditions minor disturbances can readily result in erosion and soil losses. The land supporting the virgin redwood type shows little or no erosion. The soils are porous and apparently capable of absorbing precipitation of heavy intensity. In general, the most serious erosion appears to occur in the area to the east and adjacent to the virgin redwood belt, resulting in down-stream channels filling with gravel and debris. This action is apt to complicate and increase the potential damage under flood run-off conditions.

*Material in the section on erosion has been provided by the U. S. Forest Service

DAMAGES TO WATER RESOURCES FROM POLLUTION

Four municipalities in the area with a combined population of 30,530 have constructed complete treatment plants in order to use surface water as sources of public water supply. In all of these cities chlorination alone would probably assure water of satisfactory bacteriological quality, but chemical coagulation and filtration are required to remove the high turbidity caused by erosion of farm lands and cut or burned over timber areas. (Table 10, Appendix)

Turbidity from erosion aggravated by poor farming and poorly planned logging practices, and bacterial contamination from domestic sewage are the most common forms of pollution affecting public water supplies in the Sub-basin.

There is little information available as to the water supplies developed by industries in the area. Most of the wineries and food processing plants in the Russian River valley are able to use water from wells without treatment.

Ground water is not so readily available in the Eel and Mad river valleys as it is in the Russian River valley. Lumbering is the principal industry in the area outside the Russian River basin, and it is believed that most of the mills use surface water supplies. The large mill at Scotia has had to provide a water treatment plant in order to assure water of satisfactory quality. The industries at Eureka use water from the public supply since there is no other satisfactory source available. (Table 10, Appendix)

Apparently all of the ground waters in the area are satisfactory for stock watering and irrigation. The Russian River and its main tributaries are generally satisfactory for all agricultural purposes. However, there are places in the Sub-basin, such as Santa Rosa Creek below Santa Rosa, and the Laguna de Santa Rosa below Sebastopol, which are so heavily polluted by domestic and industrial wastes that they are unsatisfactory for certain agricultural purposes.

In the Sub-basin there are few instances of aquatic life being directly affected by water pollution. According to Robert Paul, Sanitary Engineer of the Bureau of Fish Conservation of the California Division of Fish and Game, local fishermen complain that muddy water in the area obscures their lures and so makes fishing poor.

The Russian River supports a sand and gravel pit operation that constitutes a sufficient threat to have given rise to a strong county ordinance requiring the cessation of operations throughout the summer season. Due to contradictory evidence and opinions on the nature of the effect of muddy water on the growth and survival of aquatic organisms, difficulty has been experienced by the State authorities in getting convictions.

During World War II, many new small sawmills discharged mill pond effluents and sawdust to the streams. The Mad River still receives some sawmill wastes, but not enough to affect aquatic organisms.

Creamery wastes discharged into Salt Slough and into Eel River at Ferndale and Fernbridge have been the basis for serious complaints. The Eel River watershed contains no mining but there have been isolated instances of water pollution from garbage dumps, mill ponds, and sawdust.

In the North Coastal Sub-basin there are instances of diversions that create hazards for aquatic life. Much of the natural flow of the Eel River is diverted from the Van Arsdale Reservoir to the east branch of the Russian River. As a result, during low water (usually September), environmental conditions are very unfavorable for fish in that part of the river between Cape Horn Dam and the entrance of the Middle Fork at Dos Rios. It is believed that the deleterious effect may be felt all the way to the mouth of the Eel*. Lumbering operations are known to accentuate the low water condition that is accompanied by higher temperatures, decreased oxygen supply, and diminished "living quarters" for the fish. Seaward migrations are interfered with, accessibility to cooler tributaries is terminated, and young fish are increasingly exposed to natural predators.

Domestic sewage pollution at Laguna de Santa Rosa is detrimental to wild fowl and may indirectly affect the fisheries. A biological study of this problem is needed.

The potential effect of pollution on recreational use of this Sub-basin is considerable. Recreation is a major economic resource of the area and, to a large extent, is dependent upon the area's streams and other waters. The maintenance and expansion of this resource thus requires the prevention of pollution of the waters and the maintenance of adequate flows during the dry season. These two factors significantly affect the fisheries which provide a major tourist attraction in the area.

While stream samples have been collected on occasion by county health officers and by the State Department of Public Health in connection with the study of particular problems, there are no comprehensive data available in regard to the quality of the streams and other waters. Although extensive bathing and recreational activities are enjoyed throughout the Sub-basin, and there is a lack of any evidence of high incidence of water-borne diseases in the area, adequate field studies are necessary to determine whether present sources of domestic sewage pollution seriously impair the waters for recreational uses. (Table 13, Appendix)

The following is a list of complaints of damages to water resources by pollution received by the State Department of Public Health:

In 1934 a city well at Geyserville was temporarily damaged by winery wastes.

In 1935 a city well at Ukiah was temporarily damaged by winery wastes.

In 1938 there were reports of damages to a stream in Valley Ford from creamery wastes, to Sebastopol Creek from wastes from a CCC Camp, and to the Eel River from domestic sewage at Garberville.

In 1939 a stream near Trenton was damaged and a private well at Santa Rosa was permanently damaged by winery wastes.

In 1940 there were reports of damage to the Eel River from domestic sewage at Garberville and of fish killed in the Eel River by mud from a Pacific Gas and Electric Company dam.

In 1943 there were reports of damage to Santa Rosa Creek from tannery wastes at Santa Rosa and of fish killed in the Russian River by winery wastes at Asti.

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*Shapovalov, Leo, 1939 Fish Culture in the Eel River Basin, California Conservationist, February, 1939.

In 1946 the Eel River was damaged by creamery wastes at Fernbridge.

In 1947 there were reports of damages to the Russian River by domestic wastes at Cloverdale and Healdsburg, of damage to Humboldt Bay by discharges of fish processing and whale processing plant wastes at Fields Landing, and of domestic sewage from Eureka, and the Hammond Lumber Company town at Samoa, of damage to Salt Slough from domestic sewage from the city of Ferndale, and of damage to Little River from raw domestic sewage from the Lumber Company at Crannel. The Whaling Station at Fields Landing was sued by the State Department of Natural Resources, Division of Fish and Game, and fined as a result of the pollution of Humboldt Bay.

The California Division of Fish and Game reported receipt of complaints in 1949 due to discharge of apple processing wastes to Green Valley Creek near Graton. The complaints concerned odors and damage to fisheries.

BENEFITS RESULTING FROM POLLUTION PREVENTION AND ABATEMENT

Prevention and abatement of pollution in the North Coastal Sub-basin has taken place gradually over a period of six or more decades in response to growing domestic and recreational needs. Chief types of pollution include: sediments, contributed to the streams by placer and hydraulic mines and at a later date by sand and gravel mines; lumber mill wastes, including sawdust bark, and log-pond liquid wastes; industrial wastes from wineries, canneries and milk processing plants; general debris from varied types of recreational developments, principally along the Russian River, and domestic sewage from several communities.

Past and present efforts to curb stream pollution have yielded benefits, intangible but none the less substantial. Economic and health benefits have contributed to the economy and health of people in the Sub-basin as well as of people from outside the area.

The potentialities of Tomales Bay for marine shellfish culture have been preserved by maintaining the sanitary quality of these waters, and steps taken recently toward treatment of wastes from Eureka and Arcata should restore the shellfish potentialities of Humboldt Bay.

Abatement of pollution has benefited the fresh-water fisheries and various other recreational activities in the Sub-basin. For example, sawdust and millpond wastes from the extensive lumber industry once threatened the migrations of salmon and steelhead trout. The fuel value of sawdust, formerly wasted, is now recovered in the larger mills by processing into commercial fuel. Migrations of anadromous fish were benefited by the prevention of log jams, a menace to the upstream runs of spawners. Holding ponds for logs, once emptied at random to the streams and often during periods of minimum stream flow (notably at Scotia), are now subject to specific regulations of the Fish and Game Code.

With reference to recreational benefits, the U. S. Fish and Wildlife Service reports an estimated total annual fishery value of about $672,000 for only limited reaches of the Eel River. The 1947 overnight-use of the Eel River drainage area*, except for the portions below the Van Duzen confluence and above Van Arsdale Dam, was considered to be around 100 thousand fisherman-days while the day-use fishermen number an additional 100 thousand. The estimated total number of day-use visitors was 1,589,000.

The Russian River drainage area, comprising nearly 15 hundred sq. mi., likewise possesses great economic and recreational value. In 1947 investment in resorts and recreational facilities was estimated at nearly 13 million dollars and the annual patronage at about 700,000 visitor days. The extensive growth of recreational

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*Reference is made to Vicinity Map R.S. ER-7100 in Eel River Basin, California Code No. XLIII/105 Preliminary Project Report on Recreational Facilities and Potentialities for San Francisco District Engineer, Department of the Army, Corps of Engineers, submitted by National Park Service, Region Four, San Francisco, California, March 1948.

activity in the Eel and Russian River drainage areas is largely dependent upon the quality and quantity of the natural water supply. Stream conditions have benefited, to a large degree from regulations of the State Fish and Game Code making it unlawful to add to waters of the State "any substance or material deleterious to fish, plant life, or bird life".

Additional benefits to the Russian River area have resulted from regulating the outflow to streams from settling ponds used in mining sand, gravel, and gold.

Pollution from Willits, located on Broaddus Creek on the headwaters of the Eel River and Ukiah on the headwaters of the Russian River, has for years threatened valuable spawning grounds for salmon and steelhead trout. This menace to stream life has been largely removed by the erection of modern sewage treatment facilities with consequent benefits to the fish population.

Creamery wastes along the lower Eel River in the vicinity of Fernbridge and Ferndale have injured fish life periodically during the past two decades. Official reports on this situation have produced remedial measures of benefit to the fisheries. However, the problem has not been completely removed.

The past decade has witnessed restrictions that have prevented the discharge of raw sewage into the Russian River drainage area. These improvements have resulted in greatly decreasing the health hazards in the area, particularly during summer periods of low stream flows.

The Division of Water Resources, California Department of Public Works, pointed out benefits that would accrue to pollution abatement from two specific developments. First is the dollar value of increased low stream flows due to releases of water from existing and proposed flood control and multiple purpose dams. If assured minimum flows are raised it is quite possible that, due to increased dilution effects, waste treatment requirements might be less stringent to achieve a given result in the receiving waters. Another benefit mentioned results from reclamation and re-use of sewage effluent for irrigation or recharge of ground water aquifers.

With respect to reclamation and re-use of sewage effluents it is pointed out by the Division of Water Resources that such practices are "especially important in the recreational areas adjacent to Russian River where discharge of any treated sewage effluent other than of highest quality is to be avoided for esthetic reasons because of the extensive recreational use of the stream."

In this connection, it is pertinent to point out the specific responsibilities in this field placed upon the Department of Public Works by Section 2 of Chapter 1552, California Statutes 1949:

"Sec. 2. Section 230 is added to said code, to read: The Department, either independently or in cooperation with any person or any county, state, federal or other agency, to the extent funds are allocated therefor shall conduct surveys and investigations relating to the reclamation of water from sewage or industrial wastes for beneficial purposes, including but not limited to the determination of quantities of such water presently wasted, and possibilities of use of such water for recharge of underground storage or for agricultural or industrial uses; and shall report to the legislature and to the appropriate regional water pollution control board thereon, annually."

POLLUTION PREVENTION MEASURES IN EFFECT

Seven of the 19 communities in the Sub-basin with public sewer systems have provided secondary sewage treatment plants or have such plants under construction. The communities are Fortuna and Scotia on the Eel River and Cloverdale, Healdsburg, Ukiah, Talmage State Hospital, and Sebastopol on the Russian River. (Table 14, Appendix)

At Fortuna, connected population 1600, the plans and arrangements for financing construction of a new plant have been made, and construction will be completed in 1951. The plant will consist of a primary clarifier, high rate trickling filter, secondary clarifier, and separate sludge digester and will replace two old septic tanks. The new plant will be located at the site of the present south septic tank and will discharge the treated effluent to the Eel River about ten miles above the mouth. The plant design allows for a reasonable increase in population.

Scotia, connected population 1100, is a company town owned by the Pacific Lumber Company. The company completed and placed in operation in the spring of 1950 a new sewage treatment plant consisting of a primary clarifier, high rate trickling filter, secondary clarifier and separate sludge digester to replace an old septic tank. The plant effluent is discharged to the Eel River 11 miles above Fortuna.

Ukiah, connected population 5700, near the headwaters of the Russian River has two primary clarifiers and two separate sludge digestors ordinarily operated in parallel. No biological secondary treatment is provided, but the effluent is discharged to five oxidation and percolation ponds operated in series. Recently the area of the ponds has been considerably increased and is believed to be adequate to handle the flow for several years with no effluent reaching the river. A new chlorinator has been installed at the treatment plant so the sewage can be given a heavy chlorine dosage in case it has to be bypassed to the river during an emergency.

The Talmage State Hospital located across the Russian River and downstream from Ukiah treats the sewage from a connected population of 5,000 in a modern plant consisting of a primary clarifier, trickling filter, secondary clarifier and separate sludge digester. The plant effluent is ordinarily disposed of to land and does not reach the river.

At Cloverdale 1/, connected population 1,300, 31 miles downstream from Ukiah, work has been started on construction of a new primary clarifier and conversion of the existing Imhoff tank to a separate sludge digestion tank. The settled sewage is discharged to percolation beds and does not reach the Russian River except during very high river stages when the beds may be flooded.

At Healdsburg, connected population 2,500, located 17 miles downstream from Cloverdale, the domestic sewage is treated in a modern treatment plant consisting of a primary clarifier, two stage high rate trickling filters, final clarifier, and separate sludge digester. During periods of low flow the plant effluent is discharged to a percolation bed on a gravel bar of the Russian River.

Sebastopol 1/, connected population 2,500, located on a tributary

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1/ Since the data in this report were compiled, the Cloverdale and Sebastopol sewage treatment plants were completed early in 1951.

of the lower Russian River, is constructing additions to the existing sewage treatment plant. The finished plant will consist of a primary clarifier, high rate trickling filter, secondary clarifier, and digester with the effluent going to Laguna de Santa Rosa and the Russian River.

Seven of the 19 communities with public sewer systems in the Sub-basin have provided or will complete construction in 1951 of primary sewage treatment facilities for their wastes. These communities are Arcata, Point Arena, Garberville, Wildwood Sanitation District, Willits, Samoa and Santa Rosa.

Arcata, with a connected population of 3,400 located on Humboldt Bay, now has under construction to be completed in 1951 a primary sewage treatment plant consisting of a preaeration unit, primary clarifier, separate sludge digester, and chlorinator. The effluent will be discharged to Humboldt Bay.

Point Arena, connected population 375, located on the Pacific Coast approximately 200 miles south of Humboldt Bay has a septic tank for treatment of wastes before they are discharged to Ross Creek a short distance from the mouth.

Garberville, located on the South Fork of the Eel River 42 miles above Scotia, treats sewage from its connected population of 500 by passing it through a septic tank. During low water stages the effluent is discharged to a percolation bed on a gravel bar of the river.

The Wildwood Sanitary District, connected population 1,000, across the river from Scotia also provides a septic tank for sewage treatment with the septic tank effluent discharged to the Eel River.

Willits, connected population 1,600, located on the headwaters of the Eel River has a modern primary treatment plant consisting of a primary clarifier and separate sludge digester. The effluent is given additional treatment by passing it through an oxidation pond with 30 days detention before discharge to Broaddus Creek, a tributary of the South Fork of the Eel River.

Samoa, a Hammond Lumber Company town with a connected population of 600, has a new septic tank under construction. The effluent will be discharged to Humboldt Bay.

Santa Rosa[2/], connected population 15,000, provides treatment through septic tanks and oxidation ponds. The effluent is discharged to Santa Rosa Creek, a tributary of Laguna de Santa Rosa and the Russian River. During summer months the effluent is used for irrigation of hops.

It should be noted that six communities in the Sub-basin were constructing sewage treatment facilities in 1950 and that nine additional communities were making plans for construction of sewage treatment facilities in the near future. Most of this activity in the water pollution control field has been stimulated by two Acts, known as Chapter 47 and Chapter 20, passed by the California State Legislature to help develop a postwar construction program for needed public works.

Under Chapter 47, which became effective September 12, 1944, $10,000,000 was appropriated for allocation to cities, counties, and cities and counties to develop a postwar public works program comprising the preparation of surveys and acquisition of rights-of-way for proposed public works and acquisition of rights-of-way and sites for major streets, roads, bridges, sewage and other public facilities. Of the money

2/ Since the data in this report were compiled, construction has been started on a new sewage treatment plant to serve Santa Rosa and three new sewage treatment plants to serve Eureka.

appropriated, $6,875,000 was obligated for defraying up to 50 percent of the cost of preparing plans for proposed public works and $3,000,000 was obligated for payment of up to 50 percent of the cost of acquisition by local agencies of rights-of-way and sites for construction of public works projects. Small sums were also made available for administrative costs.

Chapter 20, known as the "Construction and Employment Act" became effective May 21, 1946. The Act appropriated $90,400,000 of which $400,000 was obligated for administrative expense. Of the money appropriated, $45,000,000 was alloted to the cities in the State and apportioned to the cities in the proportion that the population of each city bears to the total population of all the cities in the State as reported by the 1940 census. The construction of sewage facilities was given first priority by the Act and it was stipulated that application by cities for construction of other than sewage projects would not be considered unless the State Department of Public Health first certified that existing sewage facilities were adequate to meet the reasonable needs of the city or that provision had already been made to finance construction of needed sewage facilities. The allotments to the cities were in the form of grants made on a matching basis not to exceed 50 percent of the total cost of the project.

The Act also made $45,000,000 available to the counties of the State, one-third to be apportioned for road and bridge construction and the remaining two-thirds to be made available for construction of other projects in which there is a State interest such as hospitals, schools, sewage facilities, roads, flood control, fire prevention and harbor improvements. Sonoma and Marin counties are two of the few counties in the State that have approved use of part of their Chapter 20 county funds for construction of sewage facilities.

As originally written, any funds from the appropriation remaining unapportioned as of December 31, 1949 were to revert to the general fund but the law was amended by Chapter 92 which went in effect September 19, 1947 extending the time for allocation of funds to December 31, 1951 and for payment of encumbrances to December 31, 1952.

The Wine Institute, which represents most of the wineries in the Sub-basin, has had studies made of the winery waste disposal problems and makes the latest information on waste disposal methods available to the members of the Institute.

Wineries are classed as bonded wineries or as fruit distilleries depending upon the type of wine produced. The fruit distilleries produce some brandy and also distill part of their products to extract alcohol to fortify their sweet wines. After distillation of the alcohol, the remaining 88 to 92 percent of the liquid is waste stillage which presents a very difficult disposal problem. The wash water, grape pulp and cooling water present less serious problems. (Plate 2, Appendix)

Fortunately, all but four or five of the wineries in the North Coastal Sub-basin are bonded wineries that produce dry wine and do no distilling. The pomace or pulp which represents the greatest part of the waste is disposed of by spreading on the vineyards as a fertilizer or mulch. The wash water and lees from the bottom of the vats are usually disposed of by broad irrigation or lagooning.

Substantially, all of the large lumber mills in the area have provided waste burners to burn sawdust, shavings, and waste slabs from the milling operations. Some of the larger mills are also producing a commercial fuel from sawdust pressed into artificial logs. Section 481 of the State of California, Department of Natural Resources, Division of Fish and Game, Fish and Game Code specifically prohibits discharge of sawdust, shavings, slabs or edgings into any waters of the State. This section of the Fish and Game Code covers almost all industrial wastes, but enforcement in the case of the lumber industries has apparently been more effective than with some of the other industries.

Few of the fruit and vegetable canning plants in the Sub-basin have taken effective action toward treatment of their wastes other than to discharge the wastes to public sewer systems whenever possible. At Healdsburg the food processing plants hold their wastes until night so they will not interfere with treatment of the domestic wastes during periods of peak flows.

The U. S. Soil Conservation Service, in cooperation with other Federal and State agencies, conducts experimental and ecucational programs with the farmers of the Sub-basin. There are three soil conservation districts in this Sub-basin, and an inventory has been made of their land areas. These three districts are the Willits, Gold Ridge, and Central Sonoma Soil Conservation Districts. As a result, information will soon be made available giving a subdivision of all the land into well-defined land capability classes. An inventory of all State waters is now in its initial stages.

The State Department of Forestry and the U. S. Forest Service are actively engaged in educational work aimed toward improvement in the use of soils and forests. Technical assistance is given to farmers. Land clearing by fire and similar destructive practices that lead to erosion of various types is being discouraged in favor of modern forest management practices. These improvements are expected to reduce the amount of turbidity in local streams and rivers.

Because of comprehensive changes in legislation on water pollution control enacted by the California Legislature at its 1949 regular session, current procedures for prevention of water pollution differ drastically from those previously in effect. Prior to December 15, 1949, the effective date of the new legislation, the State Department of Public Health had primary responsibility, through provisions of the Health and Safety Code, for control of water pollution by means of a permit system. The Division of Fish and Game, the Division of Water Resources and other State governmental units also had an interest in and responsibilities for certain phases of water pollution problems.

The 1949 legislation was enacted following a two-year study conducted by a legislative Interim Fact-Finding Committee on Water Pollution. The recommendations of the Committee were used to draft a series of 11 bills which were revised and finally enacted in the 1949 legislative session.

The following summary of the new legislation was prepared by the Committee and indicates the scope and intent of this enactment:

"The existing permit law, which in theory requires that all disposals of sewage or industrial waste be controlled under permit issued by the State Department of Public Health, is repealed on December 15, 1949 (Chapter 1550). By this action the health officials are enabled to concentrate their effort upon those conditions which are, or threaten to become, actual hazards to the public health. The term 'contamination' is defined to mean '. . . an impairment of the quality of the waters of the State by sewage or industrial waste to a degree which creates an actual hazard to public health . . .' State and local health officers both are empowered to issue peremptory orders for abatement of conditions of contamination, and any person failing to correct such a condition may be guilty of a misdemeanor.

"Various sections are added to the Health and Safety Code to strengthen the powers of the state and local health officers in control of individual sewage disposal, and the act also provides for adequate supervision and control of the hundreds of so-called small water systems which were unregulated under previous law.

"Control of the economic effects of sewage and industrial waste is established by the Dickey Water Pollution Act (Chapter 1549). The terms 'pollution' and 'nuisance' are defined in the act to mean the adverse and unreasonable effects of disposal of sewage or industrial waste which are not actual hazards to health. Pollution and nuisance are subject to control by Regional Water Pollution Control Boards which are created for the nine major drainage regions of the State. The regional boards are composed of five appointees representative of the major interests involved. They have the duty to coordinate the action of the numerous governmental agencies involved and to promote cooperative action with waste producing industries. The boards are empowered to make and enforce rulings as to conditions to be maintained in all instances of pollution and nuisance, existing or threatened, within their region, but the boards may not specify the manner or means of maintaining the required conditions. Communities within a region are not prevented from adopting and enforcing additional regulations which may be deemed necessary. Upon failure of anyone to comply with an order of a regional board, an action for injunctive relief must be brought by the district attorney, or, if he should fail to act, by the Attorney General.

"A State Water Pollution Control Board is created, consisting of the State Engineer, the Directors of the Departments of Public Health, Agriculture and Natural Resources, and nine appointees representative of the regions of the State and of the various interests in these problems. The state board has the duty to undertake statewide planning for pollution control, acting in an advisory capacity to the regional boards. It will direct research programs in the technical phases of pollution control, and will administer the State Water Pollution Control Fund. The state board may act as an appeal board in any specific instance of pollution where it is found that a regional board has not taken proper action.

"An executive officer and staff is provided for each of the boards. Funds for administrative expenses are appropriated to the state board for allocation to the regional boards (Chapter 1554). The state and regional boards may obtain assistance from any state or local agency, and the state agencies most concerned with pollution

problems--the Department of Public Health, the Division of Fish and Game and the Division of Water Resources are specifically directed to cooperate with and assist the boards (Chapters 1549, 1550, 1552 and 1553).

"Financial assistance to communities for sewerage projects is provided by means of loans from a State Water Pollution Control Fund (Chapter 1551). This fund will be administered by the State Water Pollution Control Board. All or any portion of funds needed for a sewerage project may be loaned, with payments deferred as long as may be considered necessary, upon security of bonds of the community. Before state funds are loaned it must be shown that the project is feasible and cannot be financed through private sources. Cities and districts are allowed to issue 'second mortgage' revenue bonds to secure such loans, or to secure similar loans which may be available from the Federal Government or from any other source (Chapter 1555). Communities can enter into long term contracts with industry for waste disposal (Chapter 1555), and an appeal procedure for review of sewer rental charges is established (Chapter 865). Funds necessary for sewerage facilities are excluded from tax limitation in cities of the sixth class (Chapter 1253).

"The Division of Water Resources is directed to conduct a continuing survey of water quality in the State with regard to pollution from all sources (Chapter 1552). The division is directed to study all facts relating to the feasibility of reclamation of waste-water for industrial or agricultural purposes. Water-well drilling practices, as they relate to pollution of underground waters, will be investigated, and the division will recommend minimum standards for proper well construction and sealing of abandoned wells in particular areas. Reports and recommendations relating to these matters are to be made by the division to the Legislature and to the appropriate Regional Water Pollution Control Board. Every person who hereafter constructs or alters any water-well must file a detailed report with the appropriate regional board. Failure to do so, or falsification of such record, is a misdemeanor. Violation by any licensed well driller of any provision of the Health and Safety Code or Water Code relating to water-well drilling is made grounds for disciplinary action by the State Contractors' License Board (Chapter 1433). The University of California is allocated $50,000 for research in technical problems of disposal of sewage, garbage and industrial waste. (Chapter 1575)

"Continuation of the Water Pollution Committee for a second interim period (House Resolution 250) makes possible a detailed factual study of the operation of these new laws as they will be applied to the thousands of pollution problems which exist throughout the State. The scope of the committee's investigation is extended to include the other important problems of water quality which arise from agricultural use, saline intrusion, and all other sources and causes of quality impairment. In addition the committee is specifically directed to investigate the problems involved in the reclamation and reuse of waste waters, particularly in the Santa Clara Valley, (House Resolution 198), and the related statewide problems of air pollution resulting from industrial wastes and other causes (House Resolution 284)."

POLLUTION PREVENTION MEASURES REQUIRED

Public Law 845, the Federal Water Pollution Control Act, and California legislation, Chapter 1549, relating to water pollution, contain somewhat divergent provisions insofar as the delineation of pollution prevention measures required is concerned. Briefly the pertinent sections of the State and the Federal legislation and the interpretations that have been given to each by certain State authorities and by the Public Health Service respectively are as follows:-

California Legislation

Section 13053 - "Each regional board shall prescribe requirements relative to any particular condition of pollution or nuisance, existing or threatened, in the region.

Section 13054 - "Any person proposing to discharge sewage or industrial waste within any region, other than into a community sewer system, shall file with the regional board of that region a report of such proposed discharge. The regional board, after any necessary hearing, shall prescribe requirements as to the nature of such discharge with relation to the conditions existing from time to time in the disposal area or receiving waters upon or into which the discharge is proposed and notify the person proposing the discharge of its action. Such requirements may be revised from time to time. After receipt of such notice, the person so notified shall provide adequate facilities to meet any such requirements with respect to the discharge of sewage and industrial waste.

Section 13064 - "No order issued under the provisions of this article shall specify the design, type of construction or particular manner in which an operation causing or threatening to cause a condition of pollution or nuisance is to be corrected, and the person so ordered shall be permitted to correct the condition in any lawful manner.

Section 13022 - "The state board shall formulate a state-wide policy for control of water pollution with due regard for the authority of the regional boards."

On the basis of these provisions apparently it is not permissible for State authorities to pass upon the adequacy or inadequacy of existing sewerage systems and treatment and disposal facilities in advance of study of technical factors involved and any necessary hearings. Furthermore, State authorities may not specify type of sewage treatment facilities which should be provided.

Federal Legislation

Section 2 (a) P.L. 845 - "The Surgeon General shall, after careful investigation, and in cooperation with other Federal agencies,

with State water pollution agencies and interstate agencies, and with the municipalities and industries involved, prepare or adopt comprehensive programs for eliminating or reducing the pollution of interstate waters and tributaries thereof and improving the sanitary condition of surface and underground waters. In the development of such comprehensive programs due regard shall be given to the improvements which are necessary to conserve such waters for public water supplies, propagation of fish and aquatic life, recreational purposes, and agricultural, industrial, and other legitimate uses. For the purpose of this subsection the Surgeon General is authorized to make joint investigations with any such agencies of the condition of any waters in any State or States, and of the discharges of any sewage, industrial wastes, or substance which may deleteriously affect such waters."

Section 5 - "The Federal Works Administrator* is authorized, subject to the provisions of section 9(c), to make loans to any State, municipality, or interstate agency for the construction of necessary treatment works to prevent the discharge by such State or municipality of untreated or inadequately treated sewage or other waste into interstate waters or into a tributary of such waters, and for the preparation (either by its engineering staff or by practicing engineers employed for that purpose) of engineering reports, plans, and specifications in connection therewith. Such loans shall be subject, however, to the following limitations: (2) No loan shall be made for any project unless such project shall have been approved by the appropriate State water pollution agency or agencies and by the Surgeon General, and unless such project is included in a comprehensive program developed pursuant to this Act;"

On the basis of these provisions it has been reasoned that a comprehensive program must be aimed at bringing all waters within the area covered by the program to a condition acceptable for the uses to which the waters are to be put. Further, that the means by which this is accomplished should include provisions for treatment works as a means of eliminating or reducing pollution and the program should be in sufficient detail so that particular treatment works may be said to be included in the program.

In view of these circumstances the statement of needs in this report has been developed to satisfy both viewpoints by the following procedure:

TABLE A

Presentation of a list of communities which have in process some specific action for the provision of new treatment works or the alteration or extension of existing works. This is

*Note: The Federal Works Administrator's authority contained in Section 5 of P.L. 845, 80th Congress was transferred to the Federal Security Administrator under the Reorganization Plan No. 16 of 1950.

merely a presentation of factual data. In some cases Regional Board approval may already have been granted for the action; in other cases such approval will presumably be requested as the particular community's action program progresses.

TABLE B

Presentation of a list of communities which do not now have either sewage collection works, or sewage treatment works, or which lack both, and are of such a size that they might reasonably be expected to provide such facilities in the not too distant future. Such a list is desirable in connection with the financial aid features of P.L. 845, if for no other reason.

TABLE C

Presentation of a list of communities, where presently available information indicates that there may be a need for provision of improvements in or replacement of waste treatment facilities. Actual nature of improvements, however, are to be determined by the community involved at such time as the problem becomes critical and is presented to the Regional Board for its indication of the requirements to be met.

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It has not been practical to prepare tables for industrial waste pollution sources similar to the tables that have been prepared for communities as the information available on industrial waste discharges is so incomplete the tables might be misleading.

No comprehensive surveys have been made to determine the pollution preventive measures required for industries in the Sub-basin. The cases of damage to surface and ground waters from industrial wastes called to the attention of the State Department of Public Health and the State Division of Fish and Game in recent years indicate that pollution preventive measures need to be adopted by several industries. There is also a need for separation or pretreatment of industrial wastes in some communities where industrial wastes are now being discharged to municipal sewers.

Satisfactory methods of garbage disposal should be provided for communities in the area where dumps are used for garbage disposal. Dump locations should be selected far enough away from watercourses to eliminate the possibility of drainage from dumps polluting surface waters.

NORTH COASTAL SUB-BASIN

TABLE A

Communities that have recognized the need for improved waste treatment facilities and are now in the planning, financing, or construction stage:

NAME	1950 POPULATION	TYPE OF WORKS	STATUS
Arcata	3,720	Primary Treatment	Under construction
Cloverdale	1,278	Extension to existing secondary treatment plant*	Under construction
Cotati	200	Sewer system and treatment	Plans in preparation
Eureka	22,926	2 primary treatment 1 secondary treatment	Financed
Ferndale	1,025	Not determined	Engineer employed
Fortuna	1,763	Secondary treatment	Construction to be completed in 1951
Healdsburg	3,184	Extensions to existing secondary treatment plant	Engineer employed
Loleta	375	Primary treatment	Engineer employed
Occidental	250	Sewer system and treatment	Under construction
Point Arena	368	New treatment	Engineer employed
Samoa (Hammond Lumber Company)	600	Primary treatment	Under construction
Santa Rosa	17,905	Secondary treatment	Plans in preparation
Sebastopol	2,611	Extensions to existing secondary treatment plant	Under construction
Wildwood San. Dist.	1,000	Secondary treatment	Engineer employed

*Land disposal of primary treatment plant effluent to prepared percolation beds is considered to be secondary treatment rather than primary treatment.

NORTH COASTAL SUB-BASIN

TABLE B

Significant communities lacking sewage treatment facilities or sewage collection and treatment facilities:

NAME	POPULATION	COMMUNITY SEWAGE COLLECTION	COMMUNITY SEWAGE TREATMENT
Asti	110	No	No
Fernbridge	68	"	"
Fields Landing	200	Yes	"
Forestville	350	No	"
Fort Bragg	3,808*	Yes	"
Geyserville	375	No	"
Graton	500	Yes	"
Guerneville	1,089	No	"
Guernewood Park	50	"	"
Mendocino	1,200	Yes	"
Monte Rio	300	No	"
Montesano	-	"	"
Pinehurst	-	"	"
Rio Nido	50	"	"
Rockport	250	"	"
Villa Grande	18	"	"
Weott	250	"	"

*1950 population.

NORTH COASTAL SUB-BASIN

TABLE C

Communities which, on the basis of currently available information may require provision of or improvements to waste treatment facilities--no action in process and actual needs to fit Regional Water Pollution Control Board requirements:

NAME	POPULATION
Fields Landing**	200
Fort Bragg**	3,808*
Garberville	1,000*
Graton**	500
Mendocino**	1,200

* 1950 population.

**These communities were also included in TABLE "B" with communities lacking treatment facilities.

APPENDIX TO NORTH COASTAL

SUB-BASIN REPORT

THE NORTH COASTAL SUB-BASIN OF CALIFORNIA

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TABLE 1

Areal Distribution in the North Coastal Sub-basin of California

County	Area of County Square Miles	Area of County In Sub-basin Square Miles	Percent of County in Sub-basin	Percent of Sub-basin Represented by County
Mendocino	3,510	3,510	100	40.4
Sonoma	1,579	1,308	83	15.1
Humboldt	3,573	2,620	74	30.2
Lake	1,256	282	22	3.3
Marin	607	133	22	1.5
Trinity	3,191	628	20	7.2
Glenn	1,317	200	15	2.3
Total	--	8,681	--	100.0

TABLE 2

River Slopes in the North Coastal Sub-basin of California
(Data from the Department of the Army, Corps of Engineers)

River	River Reach In Miles Above Mouth		Slope in Ft/Mile
	From	To	
Eel River	Pacific Ocean	8	0.2
	8	15	4.7
	15	23	2.3
	23	37	2.7
	37	41	1.2
	41	50	3.8
	50	59	5.6
	59	77	7.4
	77	88	12.1
	88	89	50.0
	89	93	16.0
	93	114	13.4
	114	141	16.2
	141	163	21.7
Van Duzen River	Eel River	7	10
	7	30	20
	30	49	105
	49	56	2
	56	71	66
Mad River	Pacific Ocean	10	5
	10	34	14
	34	65	61
	65	102	16
Russian River	Pacific Ocean	14	1.6
	14	22	2.7
	22	35	3.7
	35	38	8.9
	46	63	8.4
	71	75	4.6
	75	80	7.4
	80	94	7.8
	94	97	16.8

TABLE 3

Hydrologic Records for the North Coastal Sub-basin of California

(Data from Department of the Interior, U. S. Geological Survey)

Station	Location	Period of Record	Flow in Sec. Ft. and Date of Occurrence			
			Maximum	Minimum	Lowest Mean	
					Monthly	Seven Consecutive days
Russian River						
East Fork Near Calpella	3 Miles East of Calpella	1941-1945	11,200 (1/21/43)	7 (12/13/43)	64 (12/13/43)	8 (12/12-18/43)
Russian River Near Hopland	4 Miles North of Hopland	1939-1945	34,100 (12/28/40)	24 (12/18/43)	100 (12/43)	32 (12/13-19/43)
Russian River Near Healdsburg	2 Miles East of Healdsburg	1939-1945	67,000 (2/28/40)	69 (7/17/43)	108 (8/40)	85 (6/22-28/40)
Russian River at Guerneville	At Highway Bridge in Guerneville	1934-1945	88,400 (2/28/40)	88 (8/19/40)	103 (8/40)	93 (8/16-22/40)
Dry Creek						
Dry Creek Near Cloverdale	5 Miles Southwest of Cloverdale	1941-1945	21,900 (1/21/43)	0.1 (9/14-24/44)	0.17 (9/44)	0.1 (10/1-10/44 & 9/14-24/44)
Dry Creek Near Healdsburg	10 Miles Northwest of Healdsburg	1939-1942	22,500 (2/28/40)	0 (10/1/39)	0 (10/11-12/40)	0

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TABLE 3 - Continued

Station	Location	Period of Record	Flow in Sec. Ft. and Date of Occurrence			
			Maximum	Minimum	Lowest Mean	
					Monthly	Seven Consecutive days
Mark West Creek						
Mark West Creek Near Windsor	4.5 Miles Southeast of Windsor	1940-1941	6,500 (4/4/41)	0.3 (9/18-23/41)	0.59 (9/41)	0.3 (9/18-24/41)
Santa Rosa Creek						
Santa Rosa Creek at Santa Rosa	A St. Bridge in Santa Rosa	1939-1941	9,080 (2/27/40)	0 (12/1-7/39)	0.2 (9/40)	0 (12/17-23/39)
Eel River						
Eel River at Hullville	One-half Mile West of Hullville	1922-1945	38,000 (12/11/37)	0 At times	36 (9/44)	23 (12/12-18/43)
Eel River at Van Arsdale Dam	Five Miles North of Potter Valley	1927-1945	40,000 (3/26/28)	0 At times	1.77 (10/39)	0.4 (12/19-25/39)
Eel River at Hearst	Highway Bridge at Hearst	1910-1913	11,200 (1/18/13)	2 (8/1-3/13)	4.3 (9/11)	4 (9/1-13/11)
Eel River at Scotia	Highway Bridge ½ Mile of Scotia	1910-1945	345,000 (12/11/37)	10 (8/12-14/40)	53.2 (9/39)	44.7 (9/24-30/39)
Potter Valley Powerhouse Tailrace	Three Miles Northwest of town of Potter Valley	1922-1945	321 (8/26/33)	0 At times	15.4 (1/44)	0 (12/9/43-1/28/44)

TABLE 3 - Continued

Station	Location	Period of Record	Flow in Sec. Ft. and Date of Occurrence			
			Maximum	Minimum	Lowest Mean	
					Monthly	Seven Consecutive days
Middle Fork Eel River						
Middle Fork Eel River near Covelo	Six Miles East of Covelo	1911-1923	47,100 (12/31/13)	2.5 (9/12/15)	9.8 (9/15)	3.7 (8/1-24/20)
South Fork Eel River						
So. Fork Eel River near Garberville	3/4 Mile Southwest of Garberville	1939-1940 1911-1913	55,600 (2/28/40)	10 (9/24/13)	11 (9/13)	10 (9/24-30/13)
So. Fork Eel River Near Miranda	Six Miles South of Miranda	1940-1945	69,200 (1/21/43)	9 (10/17/44)	35.9 (9/44)	26 (9/15-21/44)
Van Duzen River						
Van Duzen River at Bridgeville	Highway Bridge at Bridgeville	1940-1945	21,600 (1/21/43)	6 (12/12-17/45)	7.6 (9/45)	6 (9/12-18/45)
Mad River						
Mad River Near Arcata	Five Miles North-east of Arcata	1910-1913	19,000 (1/25/11)	25 (10 & 11/11)	25 (9/11)	25 (9/5-30/11)
Mattole River						
Mattole River near Petrolia	Two Miles South-east of Petrolia	1911-1913	55,600 (1/25/12)	20 (9/15-30/13)	34.7 (9/13)	20 (9/15-30/13)

TABLE 4

Trend of Population for the North Coastal Sub-basin of California Showing Portion of Sub-basin Population Contributed by Each County and The Sub-basin Total for the Period 1900 to 1950

(Data from the California State Chamber of Commerce after the U.S.Bureau of Census)

County*	Percentage** of County Population in Sub-basin	1900	1920	1940	1950
Mendocino	100	20,465	24,116	27,864	39,996
Sonoma	67.5	25,974	35,160	46,579	69,266
Humboldt	97.2	26,345	36,365	44,519	65,933
Lake	10.7	643	578	860	1,213
Marin	4.8	753	1,312	2,530	4,052
Trinity	8.3	363	211	328	417
North Coastal Sub-basin	—	74,543	97,742	122,680	180,877

* The Glenn County population within the Sub-basin was less than 100 in 1940 and hence it has not been included.

** The percent value was obtained by determining the number of people within the Sub-basin in each County by use of the 1940 census and determining the percent of the total 1940 county population this number represented. These percentages were then applied to the total county figures for other years to determine the portion of the Sub-basin population contributed by each County.

TABLE 5

Population Trends for California and for the Counties
in the North Coastal Sub-basin

(Data to which percentages were applied to obtain the figures in Table 4)
(Data from source listed in Table 4)

County	1900	1920	1940	1950 Estimate	Percent Increase 1940 to 1950
Mendocino	20,465	24,116	27,864	39,996	43.5
Sonoma	38,480	52,090	69,052	102,685	48.7
Humboldt	27,104	37,413	45,812	67,848	48.7
Lake	6,017	5,402	8,069	11,380	41.0
Marin	15,702	27,342	52,907	84,739	60.2
Trinity	4,383	2,551	3,970	5,045	27.1
State of California	1,485,053	3,426,861	6,907,387	10,472,348	51.6

TABLE 6

Economic Statistics of the Counties of the North Coastal Sub-basin of California

(Data from the California State Chamber of Commerce after the U. S. Bureau of Census, "Census of Manufacturers", and the California Crop and Livestock Reporting Service.)

County*	Number of Establishments	Average Number of Wage Earners	Wages	Value of Product	Estimated Cash Farm Income 1948
Mendocino	40	1,530	$1,779,276	$4,043,626	$15,181,000
Sonoma	185	1,564	1,613,078	17,250,000	62,939,000
Humboldt	91	4,340	5,378,963	18,010,195	19,480,000
Lake	--	--	--	--	4,778,000
Marin	54	271	361,911	2,789,318	13,615,000
**North Coastal Sub-basin	273	6,100	7,178,400	32,304,000	85,953,000

*The statistics for Lake County and both industrial and agricultural statistics for Glenn and Trinity Counties have not been included because of their relative insignificance.
**The North Coastal Sub-basin of California is considered to include all of Mendocino County, 83% of Sonoma County, 74% of Humboldt County, 22% of Lake County, 22% of Marin County, 20% of Trinity County, and 15% of Glenn County.

TABLE 7

Total Areas in Thousands of Acres of Forest and Crop Land by Counties
And for the North Coastal Sub-basin of California

(Data from Forest Service Release #4, California Forest and
Range Experiment Station, Berkeley, California)

County	Total Area	Timber Land	Cultivated Urban Industrial	Grass and Woodland Grass	Waste* Land
Mendocino	2,246	1,281	93	561	311
Sonoma	1,011	260	236	417	98
Humboldt	2,287	1,753	101	345	88
Lake	804	195	51	153	405
Marin	333	49	32	208	44
Trinity	2,042	1,668	8	124	242
Glenn	843	113	34	389	121
**North Coastal Sub-basin	5,563	3,199	432	1,310	622

*Includes chaparral, sage brush, marsh, desert, and barren land.
**The North Coastal Sub-basin of California is considered to include all of Mendocino County, 83% of Sonoma County, 74% of Humboldt County, 22% of Marin County 20% of Trinity County, 22% of Lake County, and 15% of Glenn County.

TABLE 8

Production of Lumber by Species and by Parts of Counties Within the North Coastal Sub-basin of California - Expressed in Thousands of Board Feet - 1946

(Data from the California State Chamber of Commerce after the U. S. Forest Service)

Counties	Mendocino	Sonoma*	Humboldt**	Trinity***	Total****
Number of Active Mills	93	28	94	4	219 /
Douglas Fir	63,250	8,022	149,838	4,060	225,170
Ponderosa Pine	10,754	-	80	2,654	13,488
Redwood	67,437	4,240	110,775	-	182,452
Sugar Pine	670	-	250	433	1,353
White Fir	11,667	-	5,392	19	17,078
Totals	153,778	12,262	266,335	7,166	439,760

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*Totals are used since all sawmills are in the part of Sonoma County that lies in this Sub-basin.

**Of the 100 sawmills in this County, only 6 are outside of this Sub-basin, hence production figures for the entire County are used.

***Of the sawmills in this County, only 4 are in the Sub-basin. About 20 percent of the County is in this Sub-basin, so 20 percent of the total County production figures is used.

****Figures for Marin, Lake, and Glenn Counties are small and cannot be satisfactorily estimated.

/It is estimated by the Calif. Division of Forestry that there are some 320 sawmills in the Sub-basin at present. (1950)

TABLE 9

Total County Areas, Expressed in Thousands of Acres, of Timber Cropland for All Densities of Trees and For Unstocked Areas of The North Coastal Sub-basin of California*

(Data from the California Forest and Range Experiment Station, 1946**)

County	Public	Private	Total***	Unstocked Areas		
				Public	Private	Total
Mendocino	139	1,092	1,231	22	134	156
Sonoma	1	255	256	0**	49	49
Humboldt	488	1,264	1,752	80	58	138
Trinity	181	74	255	19	6	25
Totals	809	2,685	3,494	121	247	368

*See footnotes of TABLE 8.

**Weislander, A. E., and Jensen, A. A., 1946 Forest Areas and Timber Volumes and Vegetation Types in California. California Forest and Range Experiment Station, Forest-Survey Release, No. 4, March 1, 1946.

***These figures include acreages of unstocked areas.

**Too small to be included.

TABLE 10

Summary of Public Water Supply Information for Communities
In the North Coastal Sub-Basin of California
(Data from California State Department of Public Health)

Watershed	Community	Source of Supply	Treatment	1950 Population	Estimated Population Served	1940 Consumption
Eel River	Willits	224 MG Reservoir on James Creek	Pressure filters, Chlorination	2,083	2,200	0.08 W.*
" "	Scotia	Eel River	Coagulation, Filtration, Chlorination	1,600	1,800	
" "	Wildwood S.D.	Springs & Dug Well	None	548	700	
" "	Fortuna	Well 15" diam. 28' deep	Aeration, Filtration, Iron Removal	1,763	1,800	0.069 W. 0.133 S.
" "	Ferndale	Walker Creek, Traulson Creek & Springs Creek	Hypochlorination	1,025	1,100	0.10 W. 0.15 S.
" "	Loleta	Spring-fed creek, Dug Well	None	375	375	0.015 W. 0.030 S.
" "	Garberville	Springs - dug wells - So. Fork Eel River	Hypochlorination	1,000	1,000	0.028 W. 0.070 S.
Mad River	Blue Lake	Spring-fed creeks & dug well (Mad River Valley)	None	822	800	0.008 W. 0.016 S.
Coastal	Pt. Arena	Leighton-Caselli-Meyer & Curley Springs	None	368	400	0.02 W. 0.04 S.
"	Ft. Bragg	Waterfalls Creek, Newman Gulch Creek, Novo Spring	Chlorination	3,808	6,000	0.13 W.

TABLE 10 - Continued

Watershed	Community	Source of Supply	Treatment	1950 Population	Estimated Population Served	1940 Consumption
Humboldt Bay	Eureka	Mad River	Coagulation, Filtration, Chlorination.	22,926	23,000	0.93 W. 1.39 S.
"	Arcata	Creeks & Well	Coagulation, Filtration	3,720	3,800	0.085 W. 0.180 S.
"	Samoa	Sand Points	None	600	900	0.200
Russian River	Ukiah	Dug well Gibson Creek	None	6,134	7,500	0.40 W. 1.50 S.
"	Cloverdale	Shallow well near Russian River	None	1,278	2,000	0.20 W. 0.50 S.
"	Healdsburg	4 drilled wells 55' deep, 2 dug wells 40' deep	Chlorination	3,184	3,200	1.08 S.
"	Santa Rosa	3 drilled wells 210-390' 2 creeks, 1 spring, 1 well 1 Reservoir, Lake Ralphine	Aeration, Chlorination	17,905	18,000	0.65 W. 2.20 S.
"	Sebastopol	Drilled well 285' deep " " 600' "	None	2,611	2,700	0.20 W. 0.40 S.
Mill Creek	Trinidad	Mill Creek	None	200	200	0.02

*W - winter; S - summer.

TABLE 11

The 1947 Commercial Fish Landings
For the North Coastal Sub-Basin of California

(Data from the Bureau of Marine Fisheries of the California Department of Natural Resources of the Division of Fish and Game*)

Kind	Pounds
Fin-Fish	
Sole	7,467,679
Salmon	5,867,723
Rockfish	5,503,031
Lingcod	1,529,196
Shark	942,237
Others	2,503,975
Total	23,813,841
Crustacea	
Crab	5,604,229
Mollusca	
Oyster, Eastern (Tomales Bay)	133,779
Clam, Washington	8,009
Octopus	25,250
Squid	2,750
Total	169,788
Grand Total	29,587,858

*Landings for the Sub-basin are made principally at Eureka.

TABLE 12

Estimated Number of Trout* and Salmon Fishermen Expressed in Hundreds And Their 1948 Catches in Parts of Counties Within The North Coastal Sub-Basin of California**

(Data from the Bureau of Fish Conservation of the California Division of Fish and Game***)

Counties****	TROUT		SALMON	
	Fisherman	Fish Caught	Fishermen	Fish Caught
Mendocino	178	5533	57	271
Sonoma	68	1983	-	19
Humboldt	157	5250	75	362
Trinity	32	1440	5	20
Lake	10	437	-	1
Total	445	14,643	137	673

*Trout and Steelhead Trout

**The North Coastal Sub-basin of California is considered to include all of Mendocino County, 83% of Sonoma County, 74% of Humboldt County, 22% of Lake County, 22% of Marin County, 20% of Trinity County, and 15% of Glenn County.

***Records obtained by postcard sampling method. One card was sent to every 125 fishermen. Approximate number of California sport-fishermen 957,000; number of cards returned, 5,751 or 31.8% of total number sent out.

****Figures for the parts of Marin and Glenn Counties within the Sub-basin are small and cannot be satisfactorily estimated.

TABLE 13

Estimates of 1946 Recreational Facilities by Broad Types in Three North Coastal Counties of California

(Data Provided by the U. S. Forest Service)

Item	Humboldt	Mendocino	Sonoma	Total
State Parks (Redwoods)				
Number	6	2	3	11
Area-Ac.	27,580	27	720	28,327
Number of Camping Units & Capacities	350 1,750 people	50 250 people	12 60 people	412 2,060 people
Number of Picnic Areas & Capacities	130 650 people	20 100 people	50 250 people	200 1,000 people
State Park Beaches				
Number	3	2	1	6
Area-Ac.	1,058	2,831	699	4,588
Real Property Investments in State Parks (State Park Records)	$5,712,187	$ 128,954	$ 161,169	$6,002,310
Capacity of Beaches Number of People (500 people per mile)	3,500	1,750 (Inc.approx. 3-1/3 mile county beach)	3,500 (Adjacent to NF outside)	8,750
Area and Capacity of Public Organization Camps	-	Mendocino Woodlands 5400 Ac.- Public 3 Main Camps 350 people at one time 1,000 people Total 46 season	-	-
Total Private Capacities (Rounded)	8,200	9,000	22,000	44,800
No. and Capacity Private Developments				
1. Campgrounds, No. & people	10 - 1000	10 - 2000	5-- 1000	25 - 4000
2. Resorts	5 - 1000	2 - 500	20 - 4500	27 - 6000
3. Auto Courts & Lodges	105 - 3150	110 - 3300 (Inc.approx. 50 on 101 outside)	15 - 450	230 - 6900
4. Organization Camps No. and people	-	-	15 - 1000	15 - 1000
Cabins, No. and people	600 - 300	750 --3750	4000 -20000	5350 -26750

TABLE 14

Domestic Sewage Treatment Plant Information
For the North Coastal Sub-basin of California

(Data from the California State Department of Public Health)

Municipality	Connected Population	Pop. Equiv. of Industrial Wastes	Pop. Equiv. of Plant Effluent	Treatment Units Provided	Final Disposal of Effluent	Project Status
Arcata	3,400	1,780E	3,600E	Preaeration, Primary Clarifier, Digester, Chlorinator	Humboldt Bay	New Plant to be completed in 1950
Eureka	21,000	Unknown	21,000E	None	Humboldt Bay	Engineer Employed
Fields Landing	200	-	200E	None	Humboldt Bay	Inactive
Hammond Lbr. Co.- Samoa	600	-	390E	Septic Tank	Humboldt Bay	New Plant in 1950
Fort Bragg	4,500	-	4,500E	None	Pacific Ocean	No Action
Mendocino*	1,200	-	Unknown	None	Pacific Ocean	No Action
Point Arena	375	-	300E	Septic Tank	Ross Creek-Ocean	Engineer Employed
Ferndale	900	-	900E	None	Salt Slough-Eel Riv.	Engineer Employed

TABLE 14 - Continued

Municipality	Connected Population	Pop. Equiv. of Industrial Wastes	Pop. Equiv. of Plant Effluent	Treatment Units Provided	Final Disposal of Effluent	Project Status
Fortuna	1,600	-	160E	Primary Clarifier Biofilter, Digester, Secondary Clarifier	Eel River	New Plant to be completed in 1950
Garberville	500	-	350E	Septic Tank Percolation Bed	Land or Eel River	No Action
Loleta	800	1,900E	2,700E	None	Eel River	Engineer Employed
Pacific Lbr. Co. - Scotia	1,100	-	110E	Primary Clarifier Digester, Biofilter, Secondary Clarifier	Eel River	New Plant Completed in 1950
Wildwood Sanitary District	1,000	-	800E	Septic Tank	Eel River	Engineer Employed
Willits	1,600	100E	510E	Primary Clarifier Digester, Areation ponds, 30 days retention	Broaddus Creek - Eel River	--
Cloverdale	1,300	-	850E	Primary Clarifier Digester, Percolation Beds	Land	Additions to be completed in 1950

TABLE 14 - Continued

Municipality	Connected Population	Pop. Equiv. of Industrial Wastes	Pop. Equiv. of Plant Effluent	Treatment Units Provided	Final Disposal of Effluent	Project Status
Graton*	500	-	Unknown	None	Russian River	Inactive
Healdsburg	2,500	6,000E	4,250E	Primary Clarifier 2-Stage Biofilters Final Clarifier Digester for domestic use only	Land	Engineer Employed
Santa Rosa	15,000	17,400E	10,000E	Septic Tank, Aeration ponds, Irrigation	Land or Santa Rosa Creek	Engineer Employed
Sebastopol	2,500	500E	300E	Primary Clarifier Digester, Biofilter, Secondary Clarifier	Laguna de Santa Rosa	Additions to be completed in 1950
Talmage State Hosp.	5,000	-	500E	Primary Clarifier Trickling Filter Secondary Clarifier, Digester-Irrigation	Land	--
Ukiah	5,700	-	3,700E	Primary Clarifier Digester, Percolation Beds, Chlorinator	Land	--

*Population shown is actual population, no public sewer system provided but private sewers serve some areas.

State of California

DEPARTMENT OF PUBLIC HEALTH

Wilton L. Halverson, M.D.
Director of Public Health

760 Market Street
San Francisco 2, California

September 27, 1950

Officer in Charge
California & Great Basin
Drainage Basins Office
Room 441, Federal Office Bldg.
San Francisco 2, California

Dear Sir:

The staff of this Department has reviewed the preliminary base line report on Water Pollution Control for the North Coastal Sub-basin of California including the Russian, Eel and Mad River as corrected on September 15, 1950. The subject matter of this report has been discussed with the North Coastal Water Pollution Control Board.

As you know, "pollution" as used in Public Law 845 includes any impairment of water quality, whereas in the California water pollution laws, "pollution" is limited to an impairment of quality which interferes with a beneficial use but does not cause an actual hazard to public health; and an impairment of water quality to a degree which causes a hazard to public health is called a "contamination". State and local health departments are charged with the control of "contamination" and regional water pollution control boards have jurisdiction over "pollution".

With the understanding that our comments in no way commit the State or Regional Water Pollution Control Boards, this Department, as the water pollution control agency for California dealing with Public Law 845, concurs in the conclusions and recommendations of this report.

Very sincerely yours,

/s/ Wilton L. Halverson, M.D.
Director of Public Health

WLH
EAR:MM

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Earl Warren
Governor
State of California

Office of
REGIONAL WATER POLLUTION CONTROL BOARD
North Coastal Region

707 South State Street, Ukiah

December 28, 1950

Mr. Frank E. DeMartini
Officer In Charge
California and Great Basin
Drainage Basins Office
441 Federal Office Building
San Francisco 2, California

RE: BASELINE REPORT
North Coastal Subbasin
of California

Dear Mr. DeMartini:

You will recall that this Board requested six copies of the corrected Baseline Report for the purpose of further study. These copies were received from your office and acknowledged in our letter to you dated November 22, 1950.

At the meeting in Santa Rosa on December 15, 1950, the Board unanimously requested me on their behalf to thank and commend you and your staff for the untiring efforts in preparing this excellent report as it will serve a useful purpose, giving them a handy vehicle to refer to covering the various uses of water in the North Coastal Subbasin.

The Board also requested me to advise you that it is their understanding that the State Department of Public Health has cleared this report, being the recognized agency under Public Law 845.

In view of the foregoing, this Board does not desire to take any official action on clearance as their legal authority is questionable.

Again thanking you and your staff for the excellent report and past cooperation, we remain,

Sincerely yours,

NORTH COASTAL REGIONAL
WATER POLLUTION CONTROL BOARD

/s/ William G. Shackleton,
Executive Officer

WGS:lr
cc: State W.P.C. Board

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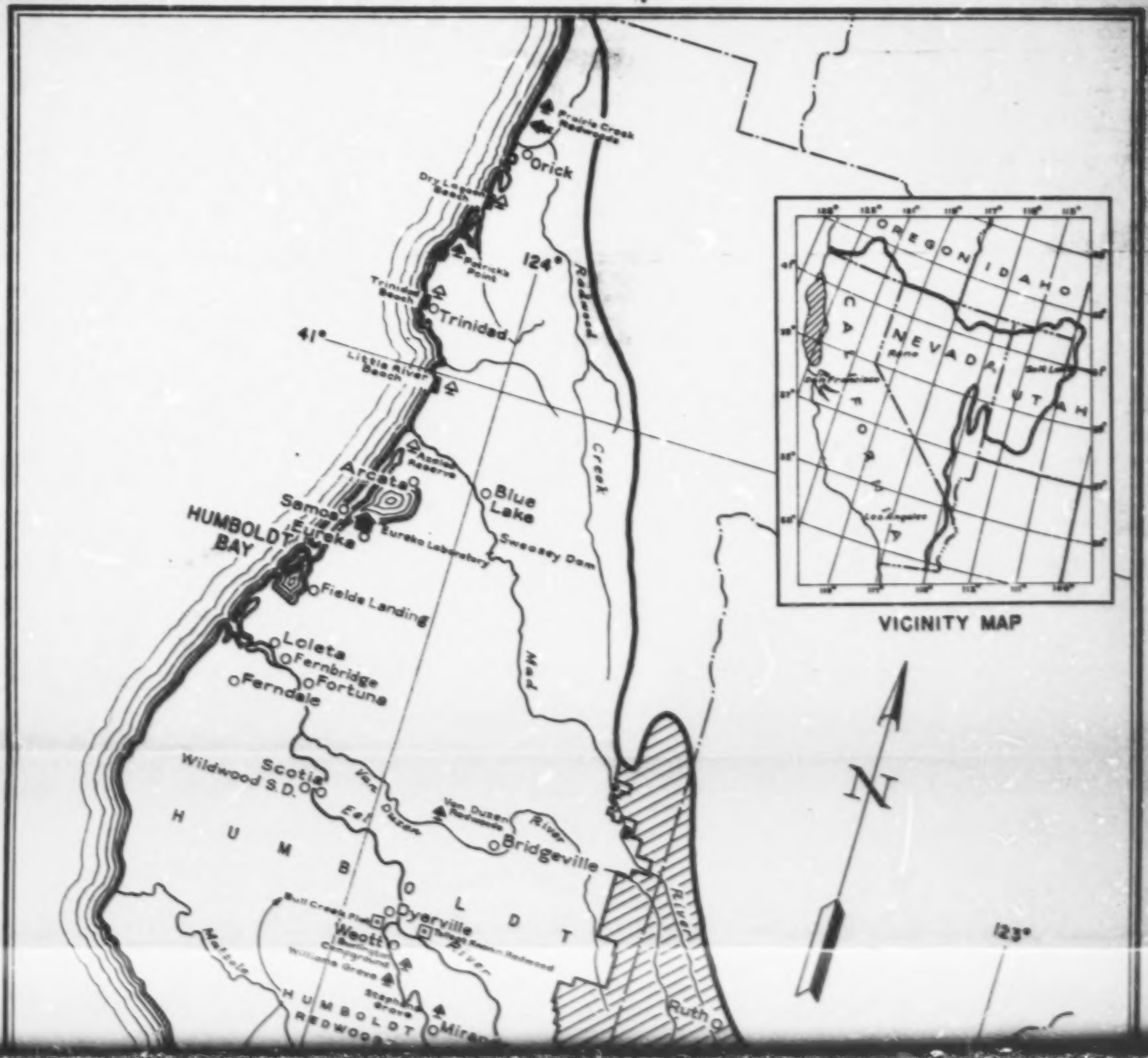
Orick
Trinidad
41°
124°
Arcata
Eureka
Blue Lake
HUMBOLDT BAY
Fields Landing
Loleta
Fernbridge
Fortune
Ferndale
Scotia
Wildwood S.D.
Bridgeville
Weott
Dyerville
Redwood Creek
Mad River
Eel River
Van Duzen River
Ruth
123°
H U M B O L D T
OREGON
IDAHO
NEVADA
UTAH
VICINITY MAP
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Bridgeville
Dyerville
Weott
Bull Creek Flat
Tallest Known Redwood
Burlington Campground
Williams Grove
Stephens Grove
Miranda
Lane Grove
Whittemore Grove
Mattole
River
HUMBOLDT REDWOODS
Eel River
South Fork
Gerberville
Richardson Grove
Benbow Dam & P.H.
Counting Station
Edward R. Hickey
Cedar Creek
Admiral Stanley Grove
Rockport
Laytonville
Branscomb
Covelo
ROUND VALLEY INDIAN RESERVATION
Middle Eel River
Outlet
Van Arsdale Dam
Snow Mtn. Egg Collecting Station
Power House
Hearst
Willits
Lake Pillsbury
Fort Bragg
Noyo River
Russian Gulch
Mendocino
Big River
Van Damme Beach
Montgomery
Ruth
Trinity River
HUMBOLDT
TRINITY
MENDOCINO
SHASTA
TEHAMA
GLENN
PACIFIC
40°
123°
124°

124°
Montgomery Redwoods
Potter Valley
Navarro River
Dimmick Grove
Elk
Calpella
East
Orr Cr.
Proposed Coyote Valley Dam
Ukiah
Talmage
COLUSA
39°
Indian Creek Grove
Manchester
Boonville
Pt. Arena
Russian
LAKE
Hopland
OCEAN
Gualala River
Proposed Dry Creek Dam
Dry
Cloverdale
Asti
River
Cr.
SONOMA
Kruse Rhododendron Reserve
Healdsburg
Armstrong Redwoods
Fort Ross
Historic Monument
Guerneville
Rio Nido
Villa Grande
Jenner
Forestville
Windsor
NAPA
Mark
West Cr.
Monte Rio
Santa Rosa
Occidental
Graton
Santa Rosa Cr.
Sebastopol
BODEGA BAY
Cotati
Tomales Pt.
Tomales Bay
123°

LEGEND

- With Campsites / Without Campsites — STATE PARKS
- POINTS OF INTEREST
- FISH HATCHERIES
- BEACH AND ROCKY SEACOAST
- NATIONAL FOREST
- COLLECTING STATION
- LABORATORY
- COUNTING STATION
- GAME FARM

SCALE IN MILES

10 5 0 10 20 30 miles

Approximately 1 inch to 10 miles

NORTH COASTAL SUBBASIN
CALIFORNIA

GENERAL REFERENCE MAP

U.S. PUBLIC HEALTH SERVICE
DIVISION OF WATER POLLUTION CONTROL

DATE FEBRUARY, 1950

PLATE NO. 1

KEY TO PLATE 2

Large Milk Products Plants and Fluid Milk Distributors in North Coastal Sub-basin of California (1947)

Map Ref. No.	Firm Name	Address
1	Cottage Grove Dairy	Arcata, Humboldt County
2	Golden State Co., Ltd.	" " "
3	Humboldt Creamery Assn.	" " "
4	Capital Dairy Co.	Eureka, " "
5	Eureka Co-Operative Dairies	" " "
6	Home Dairy	" " "
7	Golden State Co., Ltd.	Loleta, " "
8	Humboldt Creamery Assn.	Fernbridge, " "
9	Golden State Co., Ltd.	Ferndale, " "
10	Valley Floor Coop. Creamery	" " "
11	Peterson's Dairy	Scotia, " "
12	Little Valley Dairy	Fort Bragg, Mendocino County
13	Quality Dairy	" " " "
14	Spring Grove Creamery	Willits, " "
15	Willits Creamery	" " "
16	Elk Cheese Factory	Elk, " "
17	Mitchell's Creamery	Ukiah, " "
18	Pleasant View Dairy	" " "
19	Swift & Co.	Manchester, " "
20	Burbank Dairy	Santa Rosa, Sonoma County
21	California Dairy	" " " "
22	Meadow Lark Farm Dairy	" " " "
23	Santa Rosa Milk Producers Assn., Inc.	" " " "
24	Western Dairy Products, Inc.	" " " "

Wineries in the North Coastal Sub-basin of California

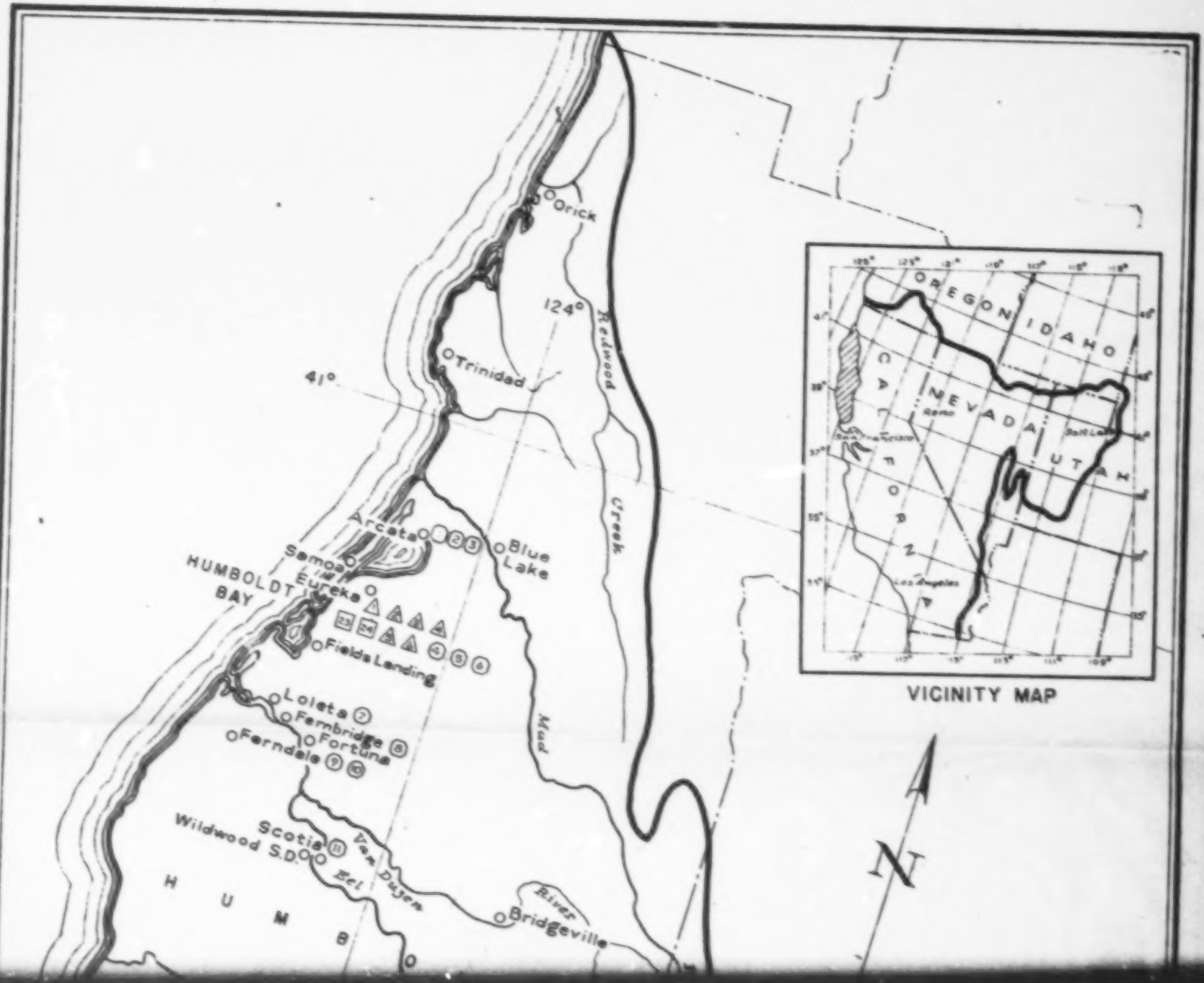
Map Ref. No.	Firm Name	Address	Type of Plant
1	American Industries Corp.	Geyserville, Sonoma County	Bonded Winery
2	Emil Bandiera	Cloverdale, " "	" "
3	E. Berti Winery	" " "	" "
4	Hollis M. Black Winery	" " "	" "
5	John Cambiaso	Healdsburg, " "	" "
6	Formerly BW 4283 of Cresta Blanca Wine Co.	Geyserville, " "	" "
7	Formerly BW 345 of Domenichelli Winery	Cloverdale, " "	" "
8	L. Foppiano Wine Co.	Healdsburg, " "	" "
9	Fountaingrove Vineyard	Santa Rosa, " "	" "
10	Fredson Winery	Geyserville, " "	" "
11	Simi Wineries (Also known as Haigh, Inc.)	Healdsburg, " "	" "
12	Louis H. Batlin	" " "	" "
13	Italian Swiss Colony	Asti, " "	Fruit Distillery & Bonded Winery
14	Caesar Mazzini	Cloverdale, " "	Bonded Winery
15	Giuseppe Mazzoni	" " "	" "
16	Frank Nervo Winery	Geyserville, " "	" "
17	Pastori Winery	Cloverdale, " "	" "
18	John Pedroncelli Winery	Geyserville, " "	" "
19	Redwood Vineyard & Winery	Healdsburg, " "	" "
20	Santa Nella Vineyards	Guerneville, " "	" "
21	Alta Vineyards Company	Healdsburg, " "	" "
22	Seghesio Winery	Geyserville, " "	" "

Map Ref. No.	Firm Name	Address	Type of Plant
23	Walter Sink	Cloverdale, Sonoma County	Bonded Winery
24	Sonoma Vineyards Winery	Healdsburg, " "	" "
25	Sotoyome Vineyards Co.	" " "	Bonded Wine Storeroom
26	Vinland Winery	Cloverdale, " "	Bonded Winery
27	Vercelli Bros. Wine Co.	Healdsburg, " "	" "
28	Windsor Winery	Windsor, " "	" "
29	Sonoma County Coop. Winery	" " "	" "
30	Northern Sonoma Wines, Inc.	Geyserville, " "	" "
31	C. Schilling Company	Cloverdale, " "	" "
32	Roma Wine Company	Healdsburg, " "	" "
33	Formerly BW 3179 of Dewey F. Baldocchi	Windsor, " "	" "
34	Branger Vineyard	Santa Rosa, " "	" "
35	William F. Chisholm	Windsor, " "	" "
36	Simi Wineries (Also known as Haigh, Inc.)	Healdsburg, " "	Bonded Wine Storeroom
37	Andrea Ghiotti	Cloverdale, " "	Bonded Winery
38	F. Korbel & Bros., Inc.	Guerneville, " "	Fruit Distillery and Bonded Winery
39	Albert Lagomarsino	Santa Rosa, " "	Bonded Winery
40	Fred Martinelli	Forestville, " "	" "
41	Mazzetti Winery	Windsor, " "	" "
42	Emilia Oneto	Healdsburg, " "	" "
43	Norton & Haigh	" " "	" "
44	Petri Wine Company	Forestville, " "	" "
45	Steve Ratto	Cloverdale, " "	" "
46	The Speas Company	Sebastopol, " "	Fruit Distillery and Bonded Winery
47	Lucca Winery, Inc.	Forestville, " "	Bonded Winery
48	Valliant & Sons Vineyards	Santa Rosa, " "	Bonded Wine Storeroom

Map Ref. No.	Firm Name	Address	Type of Plant
20	Miller Fruit Co., Inc.	Healdsburg, Sonoma County	Carrots, potatoes
21	Rosenburg Bros. & Co.	" " "	Prunes, raisins, apples, currants, plums
22	Geo. Sherriffs	" " "	Prunes
23	Wellman, Peck & Co.	Eureka, Humboldt "	Jams, jellies, preserves, peanut butter
24	Harold F. Churchill Co.	" " "	Apricots, peaches, asparagus, beans, broccoli, brussel sprouts, corn, cauliflower, berries

Fish Products Processing Plants in the North Coastal Sub-basin

Map Ref. No.	Firm Name	Address	Type of Plant
1	Hallmark Fisheries	Eureka, Humboldt County	Frozen Fish
2	Tom Lazio Fish Co.	" " "	Fish
3	New England Fish Co.	" " "	Fish
4	Norcal Packing Co.	" " "	Fish
5	Theo. Weissich Fish Co.	" " "	Petrale fillets, rock cod fillets, sablefish fillets, sole fillets
6	Maritime Industries	" " "	Sardines, fish meal & oil


Orick
124°
Redwood Creek
Trinidad
41°
Arcata
Samoa
Eureka
HUMBOLDT BAY
Blue Lake
Fields Landing
Loleta
Fernbridge
Fortune
Ferndale
Mad
Scotia
Wildwood S.D.
Eel
Van Duzen
River
Bridgeville
H U M B
OREGON
IDAHO
NEVADA
UTAH
VICINITY MAP
N

123°
SHASTA
TEHAMA
GLENN
TRINITY
MENDOCINO
HUMBOLDT
River
Ruth
Covelo
Hearst
Eel
Outlet
Cr.
Willits
Bridgeville
Miranda
Garberville
Laytonville
Branscomb
Weott
Van Duzen
Eel
South
Fork
Rockport
Noyo River
Fort Bragg
Mendocino
Matole
40°
PACIFIC

GLENN
COLUSA
LAKE
NAPA
Lake Pillsbury
Hearst
Potter Valley
Redwood Valley
Calpella
Ukiah
Talmage
Russian
Cr.
Willits
Broaddus
Cloverdale
Asti
River
Dry
Windsor
Healdsburg
Santa Rosa
Sebastopol
Forestville
Guerneville
Jenner
Hopland
Boonville
Noyo River
Big River
Navarro River
Elk
Manchester
Mendocino
Pt. Arena
Gualala River
Fort Ross
SONOMA
OCEAN
39°
124°

LEGEND

- ○ Wineries
- □ Fruit and Vegetables Packing Plants
- △ Fish Processing Plants
- ○ Milk Products Plants

SCALE IN MILES

10 5 0 10 20 30 miles

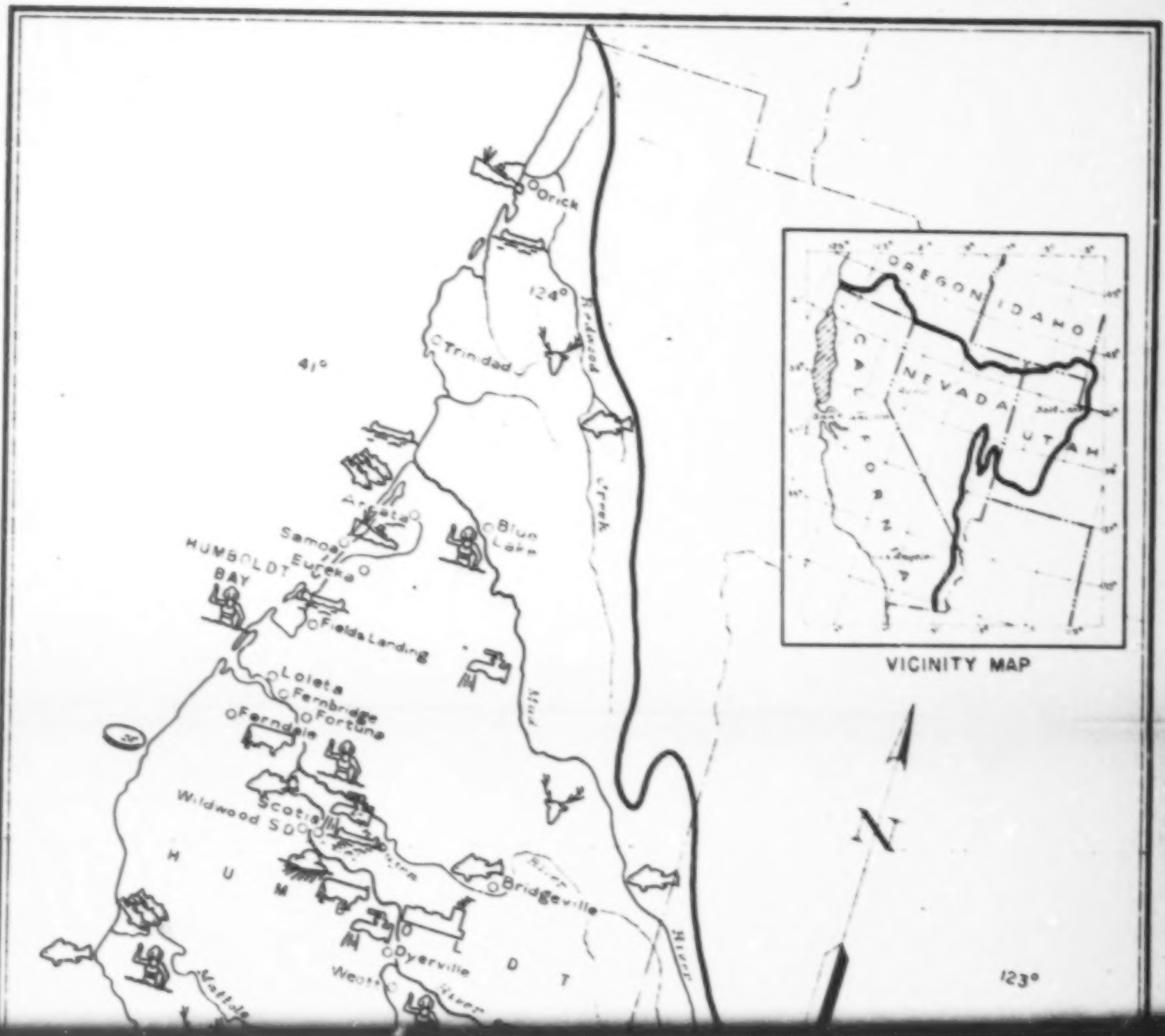
Approximately 1 inch to 10 miles

NORTH COASTAL SUBBASIN
CALIFORNIA

LOCATION OF WINERIES AND FOOD PROCESSING PLANTS

U.S. PUBLIC HEALTH SERVICE
DIVISION OF WATER POLLUTION CONTROL

DATE FEBRUARY, 1950 PLATE NO. 2


Orick
124°
Trinidad
41°
Redwood Creek
Arcata
Samoa
Eureka
Blue Lake
HUMBOLDT BAY
Fields Landing
Loleta
Fernbridge
Fortuna
Ferndale
Scotia
Wildwood SD
Bridgeville
Dyerville
Weott
Eel River
Van Duzen River
H U M B O L D T
123°
OREGON
IDAHO
NEVADA
UTAH
CALIFORNIA
VICINITY MAP
N

123°
SHASTA
TEHAMA
GLENN
TRINITY
MENDOCINO
HUMBOLDT
River
Eel
Covelo
Hearst
Outlet
Cr.
Willits
Bridgeville
Dyerville
Miranda
Garberville
Laytonville
Branscomb
Rockport
Fort Bragg
Mendocino
Matthole
40°
PACIFIC

Fort Bragg
Mendocino
Navarro River
Willits
Big River
Hearst
GLENN
Lake Pillsbury
124°
Potter Valley
Calpella
East
Ukiah
Talmage
COLUSA
39°
Pt Arena
Boonville
Hopland
LAKE
OCEAN
Cloverdale
Ast.
SONOMA
Healdsburg
Fort Ross
Guerneville
Jenner
Forestville
Windsor
NAPA
Santa Rosa
Sebastopol

- Domestic Water Supply
- Industrial Water Supply
- Livestock
- Irrigation
- Commercial Fishing
- Game Fishing
- Shellfish
- Wildlife
- Bathing Water
- Other Recreation
- Navigation

SCALE IN MILES

0 10 20 30 miles

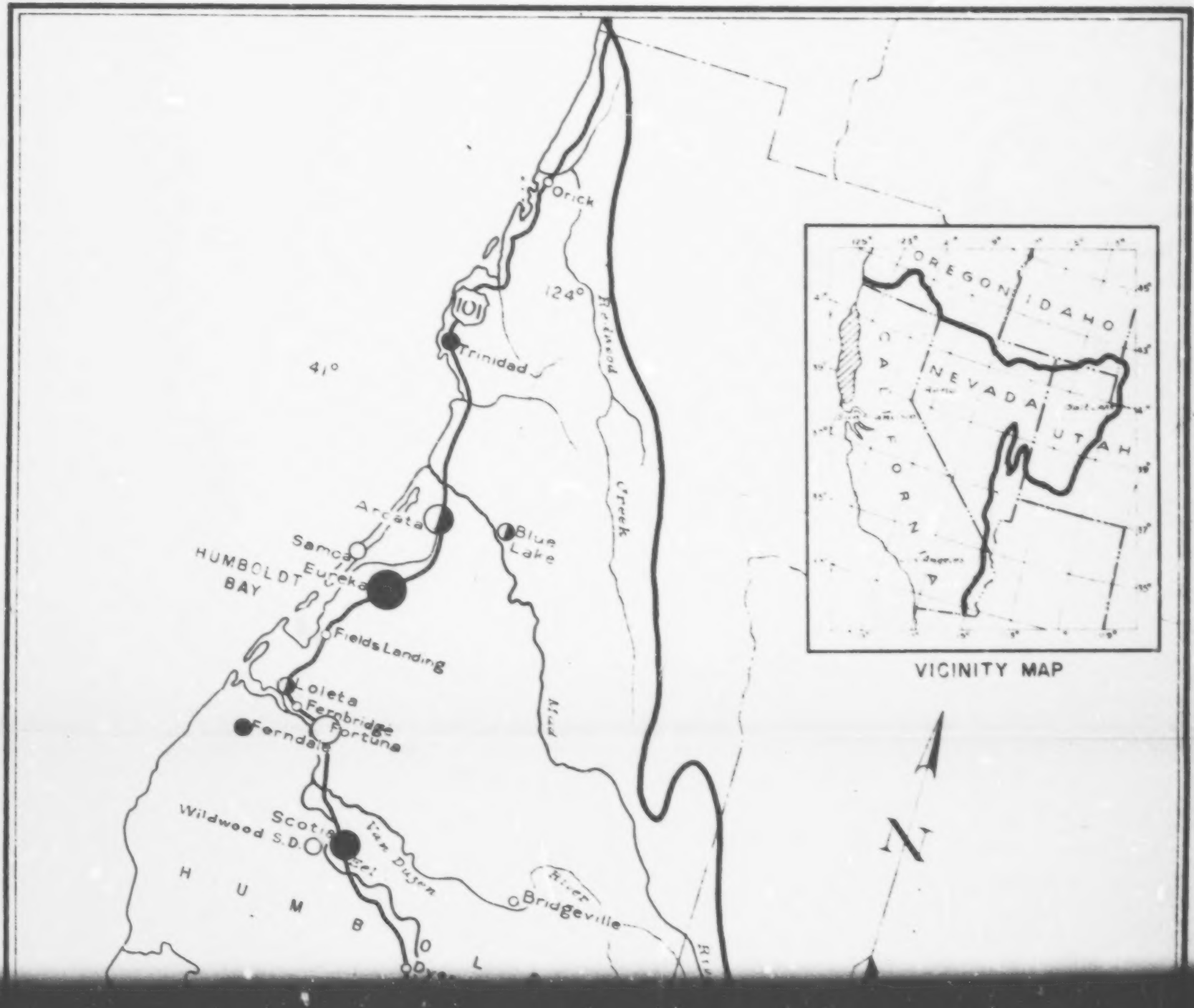
Approximately 1 inch to 10 miles

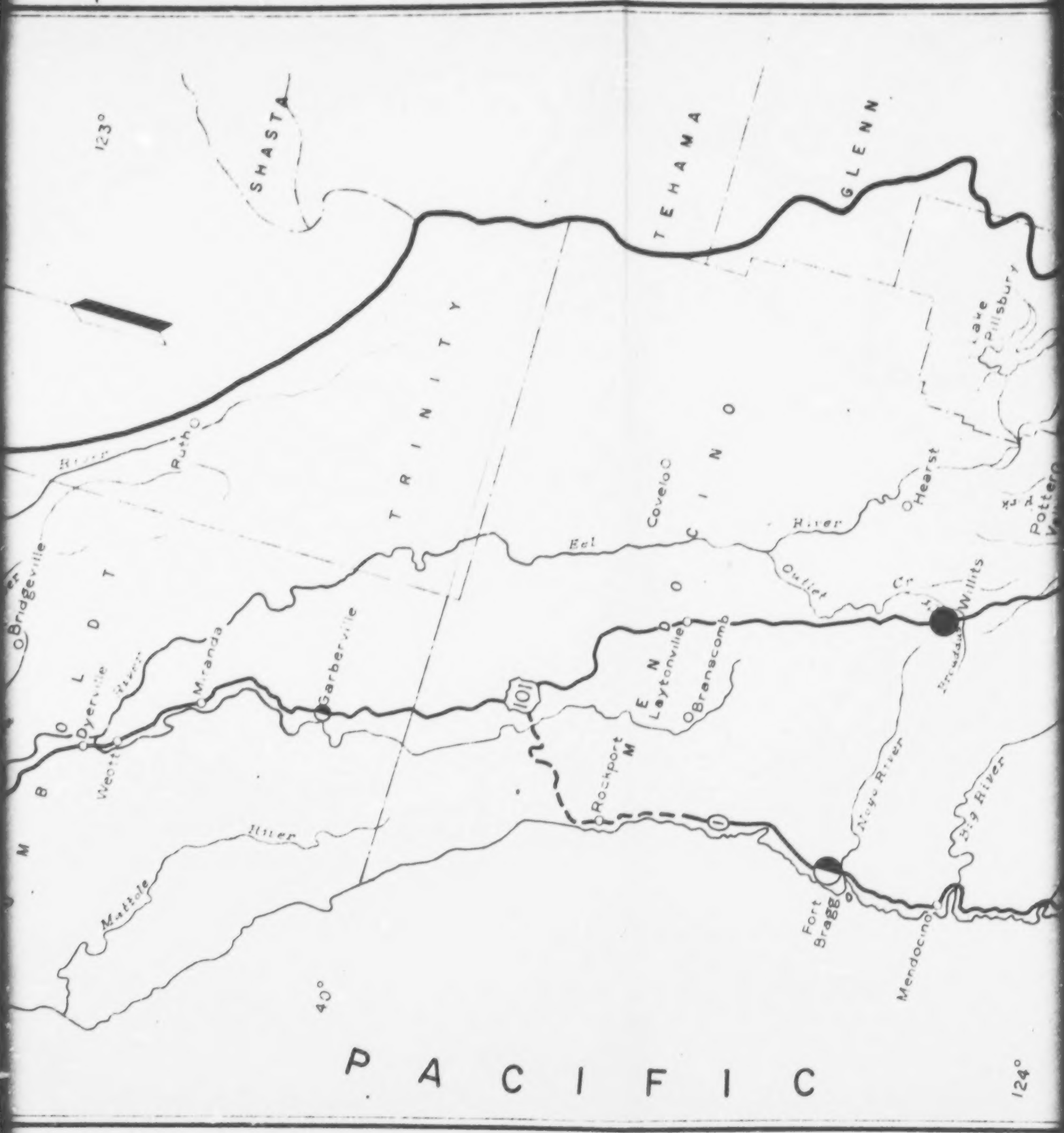
NORTH COASTAL SUBBASIN
CALIFORNIA

EXISTING PRIMARY WATER USES

U.S. PUBLIC HEALTH SERVICE
DIVISION OF WATER POLLUTION CONTROL

DATE JULY, 1950 PLATE NO 3


Orick
101
124°
41°
Trinidad
Redwood Creek
Arcata
Blue Lake
Samoa
Eureka
HUMBOLDT BAY
Fields Landing
Loleta
Fernbridge
Fortuna
Ferndale
Wildwood S.D.
Scotia
Eel River
Van Duzen River
Bridgeville
H U M B O L
OREGON
IDAHO
NEVADA
UTAH
CALIFORNIA
VICINITY MAP
N


123°
SHASTA
TEHAMA
GLENN
TRINITY
MENDOCINO
Lake
Pillsbury
Ruth
Hearst
Eel River
Covelo
Outlet Cr.
Willits
Bridgeville
Dyerville
Weott
Miranda
Garberville
101
Laytonville
Branscomb
Rockport
Mattole River
Eel River
Noyo River
Big River
Fort Bragg
Mendocino
40°
PACIFIC
124°

124°
39°
OCEAN
Pillsbury
Potter Valley
East
Calpella
Ukiah
Talmage State Hospital
COLUSA
LAKE
NAPA
SONOMA
Navarro River
Boonville
Pt Arena
101
Hopland
Eel River
Russian River
Ast
Healdsburg
Windsor
Fort Ross
Guerneville
Jenner
Forestville
Santa Rosa
Sebastopol
Cotat
BODEGA BAY
Tomales Pt
1
12

LEGEND

SURFACE AND UNDERGROUND SUPPLIES	UNDERGROUND SUPPLIES	POPULATION SERVED
◑	○	1000 & UNDER
◑	○	1001 TO 10 000
◑	○	10 001 TO 100 000

● SURFACE SUPPLIES

SCALE IN MILES

0 10 20 miles

Approximately 1 inch to 10 miles

NORTH COASTAL SUBBASIN
CALIFORNIA

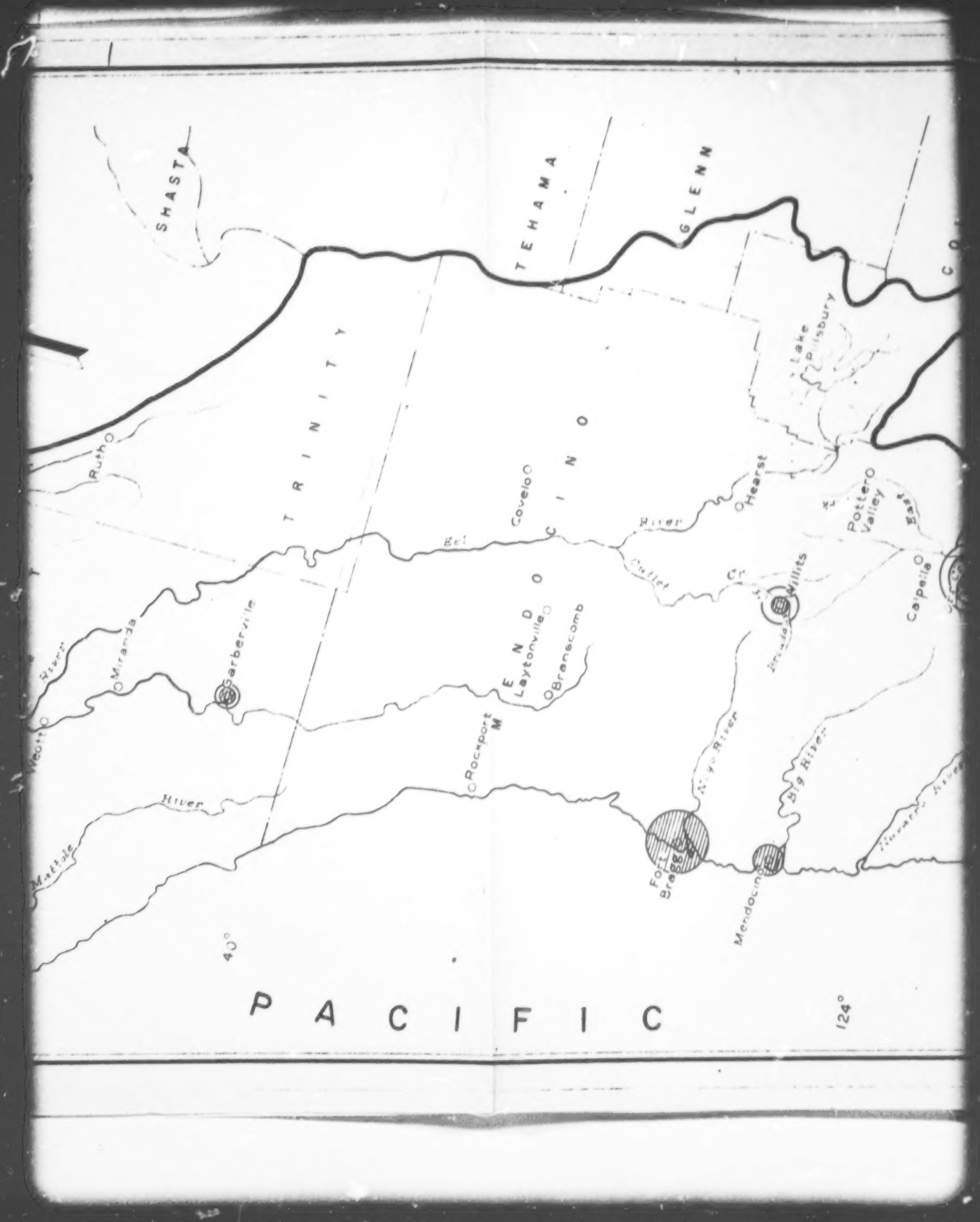
COMMUNITY WATER SUPPLIES

U S PUBLIC HEALTH SERVICE
DIVISION OF WATER POLLUTION CONTROL

DATE JULY, 1950

PLATE NO 4

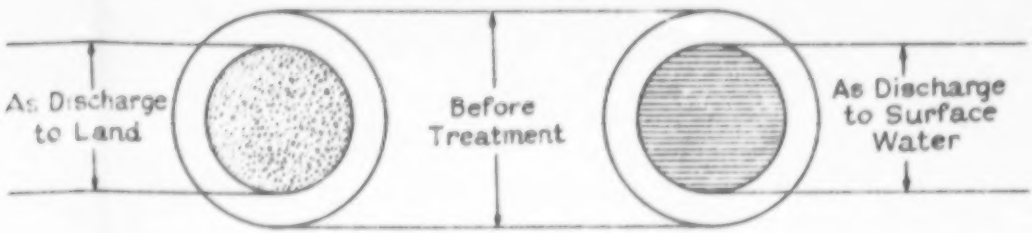
Orick
124°
Trinidad
41°
Blue Lake
Arcata
Eureka
HUMBOLDT BAY
Fields Landing
Loleta
Fernbridge
Fortuna
Ferndale
Scotia
Bridgeville
Dyerville
Weott
Mattole
Ruth
H U M B O L D T
123°
OREGON
IDAHO
NEVADA
UTAH
CALIFORNIA
VICINITY MAP
N


SHASTA
TEHAMA
GLENN
TRINITY
MENDOCINO
Ruth
Covelo
Hearst
Lake Pillsbury
Potter Valley
East
Eel River
Outlet Cr
Willits
Calpella
Miranda
Garberville
Laytonville
Branscomb
Weott
Rockport
Mattole River
Eel River
Big River
Ukiah
Fort Bragg
Mendocino
40°
PACIFIC
124°

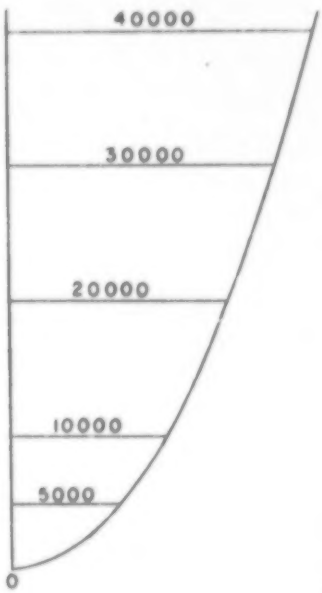
COLUSA
LAKE
NAPA
SONOMA
OCEAN
Potter Valley
Ukiah
Calpella
Hopland
Boonville
Redwood Valley
Healdsburg
Windsor
Santa Rosa
Sebastopol
Forestville
Guerneville
Jenner
Fort Ross
Gualala River
Navarro River
Pt Arena
BODEGA BAY
Tomales Pt.
39°
124°

LEGEND

AREAS OF CIRCLES PROPORTIONAL TO POPULATION EQUIVALENT OF WASTES



POPULATION EQUIVALENT



SCALE IN MILES

0 5 10 20 30 40 miles

Approximately 1 inch to 10 miles

NORTH COASTAL SUBBASIN
CALIFORNIA

POLLUTIONAL LOAD FROM PUBLIC SEWERAGE SYSTEM

U S PUBLIC HEALTH SERVICE
DIVISION OF WATER POLLUTION CONTROL

DATE JULY, 1950 PLATE NO 5